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Andrews University

School of Education

**A STUDY OF THE REPORTED LONG-TERM ATTITUDINAL AND BEHAVIORAL
EFFECTS OF AN EIGHTH-GRADE ENVIRONMENTAL EDUCATION PROJECT
AND THE DEVELOPMENT OF AN INNOVATION CONFIGURATION
TO PROMOTE ENVIRONMENTAL EDUCATION**

A Dissertation

Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

Jean Lomino

December 2002

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APPROVAL BY THE COMMITTEE:




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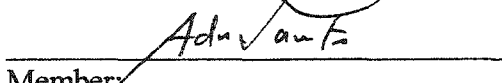
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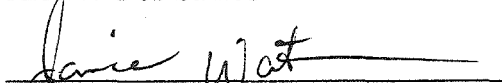
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ABSTRACT

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Chair: James A. Tucker

ABSTRACT OF GRADUATE STUDENT RESEARCH

Dissertation

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Name and degree of faculty chair: James A. Tucker, Ph.D.

Date completed: December 2002

Problem

Increasing scientific evidence reveals that this planet is in serious environmental jeopardy. Since 1977, when an international group of K-12 educators met in the USSR and established goals for teaching environmental education worldwide, many schools have endeavored to fulfill these goals through the use of various curricula and teaching strategies. Although some progress has been made, most K-12 public schools have not done enough to meet the demands of environmental problems. In 1996, my co-teacher

and I designed and implemented an environmental project, called Mission Environment, that we hoped would help our students develop long-term positive environmental attitudes and behaviors.

Purpose

This study is an attempt to discover how effective the Mission Environment project (ME) was in contributing to long-term, positive environmental attitudes and behaviors among the participating students.

Methodology

The study used quantitative and qualitative methods. Data were collected by surveying the members of a high-school senior class to determine their current environmental attitudes, behavior, affect, and knowledge. Of the 71 students surveyed, 28 indicated that they had been ME participants during their eighth-grade year (1996-97). The survey data were analyzed using the students' independent samples t test and chi square.

Additionally, through student interviews, the study investigated the hypothesis that the teaching methods used during the course of the project contributed to producing these long-term effects. As a result of reflective interviews about the ME project and data from the literature review, a model has been created for a middle-school environmental education project in the form of an Innovation Configuration. This model is presented as part of the results of this study.

Findings and Conclusions

The results of the statistical analysis of the environmental survey data showed statistically significant differences between the ME participants and the non-participants. The ME participants reported more positive environmental attitudes, behavior, and affect than the non-participants. However, there was no statistically significant difference between the two groups of students in environmental knowledge. From these findings, it could be conjectured that the possession of knowledge about the environment is not necessarily an indicator of positive conservation behavior. This conclusion is consistent with the findings of several researchers who suggest that environmentally relevant behaviors do not naturally evolve from knowledge, but appear to be the result of knowledge combined with the application of action strategy skills.

Additionally, the student interviews seemed to suggest that the students acquired other positive benefits from the project. The study highlighted the importance of environmental education projects like ME, which integrate experiential, service-learning opportunities.

With love and gratitude to my husband and children, Joe, Jeff, Jerry, and Julie; my brother Ron, sister-in-law Mary; my mother, Lillian Hagen Roll; my friend and mentor, Dr. Ingrid Jones; my committee, Dr. James Tucker, Dr. Hinsdale Bernard, Dr. Alberto dos Santos, and Dr. Carl Swafford; and to the many others who provided support and encouragement during the process of completing this dissertation and my doctoral program

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CHAPTER ONE

INTRODUCTION

Evidence, as seen through a microscope and on a global scale, suggests that Planet Earth is in serious jeopardy. Water tables are diminishing on every continent. According to Brown, Flavin, and French (1998) in their book *State of the World*, 70% of all water pumped from underground, or from rivers, is being used for irrigation leading to a future of food scarcity. In Africa, besides the dwindling water sources, the loss of topsoil due to erosion is threatening the food supply for the 719 million people of today, and for the 1.45 billion in the year 2025. During the past century, over half of the world's original forests have been destroyed. One-third of all species of fish, both fresh and saltwater, and one in four mammals is in danger of extinction. Brown et al. explain further:

As various life forms disappear, they affect the entire ecosystem and particularly the basic services provided by nature, such as pollination, seed dispersal, insect control, and nutrient cycling. This loss of species is weakening the web of life, and if it continues, it could tear huge gaps in its fabric, leading to irreversible changes in the Earth's ecosystem. Unless humanity stabilizes the global atmosphere that we have been steadily altering for more than a century, virtually every ecosystem on Earth will be at risk. (p. 11)

The causes of this predicament are complex and may include a rapidly expanding world population, the greenhouse effect, ozone depletion, and water pollution (Brown et al., 1998). These crises signal devastating effects on a humanity that continues to have a

poor environmental ethic and an equally poor preservation track record. At the same time, people seem to be experiencing an ever-increasing lack of connectedness with the natural world. More than 50 years ago, Aldo Leopold (1949) warned that the American attitude toward nature was one of ownership and consumption, not stewardship and conservation.

The environmental movement of the 70s and 80s forced Americans to rethink their relationship with nature. The resulting view was one of harmony and symbiosis with the earth (Toffler, 1980). However, that attitude began to change with the dawn of a new technological age. Young people now use their free time surfing the net and sitting for endless hours watching entertainment via satellite dishes, rather than interacting with nature (Lieberstein, 1991).

In 1994, the National Environmental Education and Training Foundation conducted a survey of students nationwide in Grades 4-12. Fifty-six percent reported that the key to getting youth involved in environmental issues was getting them close to nature (Rockland, 1995). This finding suggests that environmental knowledge and behavior are related to an individual's connectedness to the natural world.

Another recent survey by the National Environmental Education and Training Foundation (NEETF) on a nationally representative sample of 2,000 Americans, ages 18 and older, revealed that there is a relationship between environmental knowledge, concerns, and behaviors. Day-to-day activities that directly or indirectly benefit the environment (i.e., recycling, conserving household electricity and water, reducing the purchase of expendable items) increase proportionately with the level of environmental knowledge (NEETF, 1998).

Since a connection appears to exist between action and knowledge, education may be a possible solution to the downward environmental spiral. Among those who hold this opinion is former United States Secretary of Education, Richard Riley. He states that adults have an obligation to teach children to respect the environment if we want to protect our natural resources (Riley, 2000). Ninety-five percent of adult Americans agree that environmental education should be taught to children in school (Environmental News Network, 1997). "What is important is that we teach them from an early age to base their decisions not only on what is easiest, fastest, or cheapest, but also on what is healthy for the environment" (Tonies, 1990, p. 8).

As long ago as 1977, an international group of K-12 educators met in Tbilisi, Georgia, USSR, and established goals for teaching environmental education worldwide. The recommendations included 12 guiding principles which can be summarized in five broad objectives: (a) developing an awareness and sensitivity to the environment, (b) developing a knowledge of the environment and its problems, (c) developing attitudes of concern for the environment and motivation to participate in positive environmental practices, (d) developing skills requisite for identifying and resolving environmental problems, and (e) developing participation in environmental problem solving (Volk, Hungerford, & Tomera, 1984).

Have schools met these objectives? In the years since the Tbilisi conference, Ramsey, Hungerford, and Volk (1992) determined that although some progress is being made, K-12 public schools have not done enough to meet the demands of environmental problems. They recognized that some curricular programs exist, but are not being used.

The researchers identified a need for a more comprehensive approach to environmental education.

Kirk, Wilke, and Ruskey (1997) conducted a survey in the United States to determine what progress has been made since the *Tbilisi Declaration* was published in 1978. They found some positive improvement, but no state had successfully incorporated all of the components of environmental education into its programs.

From these findings we can conclude that, although the urgent need for an environmental education curriculum in our schools is recognized, what is actually being implemented may not be meeting the challenge of preparing tomorrow's citizens to deal with the global problems of the 21st century. Are there environmental education curricula or methods that can successfully produce environmentally appropriate behaviors? And once positive environmental attitudes and behavior are acquired, what are their long-term effects? Such questions await answers.

Most environmental education programs have been designed on the traditional linear model for changing behavior: Knowledge leads to awareness which results in action (Hungerford & Volk, 1990). But many educators believe that to help students develop the attitudes which will produce long-term environmentally appropriate behaviors, they need direct experiences. They need to participate in real-life projects which provide service to their communities. A study conducted by Howe and Disinger (1988) concluded that the most effective instructional strategies for developing environmental responsibility were case studies, field trips, community inventory projects, and community action projects.

Ramsey and Hungerford (1989) studied the effects of an outdoor education

program that was based on environmental-issue investigation and action training for seventh-grade students. The treatment for the experimental group focused on allowing autonomous student behavior, which included problem-solving and the development and use of environmental action skills for specific environmental issues. The control group received the usual science instruction. After 18 weeks, the experimental group reported significant changes in their environmental behavior and knowledge. The control group did not report such changes.

Matthews and Riley (1995) determined that the programs most likely to change behavior involve authentic, environmentally positive experiences, content which connects students with relevant issues, and long-term projects with active support, follow-up, and genuine role models.

The purpose of this dissertation is to study the long-term effects of a middle-school environmental education project that was taught using similar non-linear strategies. During the years 1996-1999, I co-developed and taught an experiential, service-learning-based environmental project. This study is an attempt to discover how effective the project was in contributing to long-term, positive environmental attitudes and behaviors.

Background

In 1996 while teaching seventh- and eighth-grade English in a private, parochial K-12 school, my co-teacher and I began searching for an environmental project for our students. We were looking for something that would incorporate experiential, project-based teaching strategies and that would also integrate my English curriculum with his

science curriculum. We were looking for a way to give our eighth-grade students opportunities to work together, to love and care for the earth, and to make a positive contribution to their community.

In the spring of that year we learned about a school in Florida that had created an environmental education project involving student monitoring of local lake-water quality. They called themselves, "Eagle Eye, Inc." (See Appendix A.) We decided to develop a similar project in our community of Collegedale, Tennessee.

About 20 years ago, Wolftever Creek, the watershed for our valley, was significantly polluted, partly due to run-off from a locally based industry. Through the combined efforts of local citizens, county, and state agencies, the creek was cleaned up. But in the intervening years, the creek was again largely ignored. Trash was visible in the water and along its banks, and there seemed to be a general lack of awareness concerning "non-point source" pollution (caused by individual carelessness, rather than by specific industrial action) and its effect on the water quality of Wolftever Creek. We felt that we could help remedy the situation by educating the community about the importance of preserving this natural resource. Our program, which evolved into a legal, non-profit corporation, "Mission Environment" (ME), lasted 4 years and engaged the minds and talents of more than 200 students.

Pedagogically, our environmental project was built upon the philosophy of constructivism, an alternative to the traditional objective view of knowledge (students receiving knowledge from the teacher). The theory of constructivism suggests that learners actively construct their own knowledge and that learning is closely related to the situation

or context in which it takes place (Resnick, 1989).

The project also incorporated experiential education, outdoor education, and service learning. Experiential education actively engages students in experiences that have real consequences (Kraft & Sakofs, 1988). The purpose of outdoor education is “to provide meaningful contextual experiences—in both natural and constructed environments—that complement and expand classroom instruction, which tends to be dominated by print and electronic media” (Knapp, 1996, p. ix). Service learning involves students in planned experiences that allow them to apply what they have learned in the classroom to meaningful work and service in their community (Totten & Pedersen, 1997). These models of learning will be described in greater detail in chapter 2.

We wrote a proposal for our project, using Susan Kovalik’s (1982) “Integrated Thematic Instruction” model and including the skills needed for the 21st century, identified by the U. S. Department of Labor Secretary’s Commission on Achieving Necessary Skills (SCANS, 1991). (See Appendix B.)

When I contacted the city manager about our plans, he informed me that the city commission had been studying the idea of building a greenway along the creek, but the proposal had recently been tabled. If our students could inspire support for the greenway, he said, maybe the community would get excited about it too. Our project now had a focused objective.

After receiving school approval, the students began phase one, which was to build a museum in my classroom featuring the flora and fauna of Wolftever Creek, as well as the Native American history and Civil War history of the area. Every student worked with a

partner to do research in one of these subjects. Then each team created a poster, which was first exhibited in the school hallway and later in the museum. A talent search was conducted to create student teams for public relations, video production, art, writing, exhibit construction, research, fund-raising, and web page design.

The finance team planned and conducted a fund-raiser to help get the greenway started. A video was produced by the video and writing teams and was shown to the school board, local churches, and the city commission. At the city commission meeting, the students also presented a logo for the greenway, designed by the art team, and a \$200 donation for the greenway construction.

Students explored the creek many times to study and collect specimens, to pick up litter, test water quality, and measure water depth and flow. The art group, with the help of a local university professor, turned one classroom wall into a mural depicting riparian environments. The history team explored an old mill site on the creek with a state archaeologist. Students also wrote and illustrated primary-level books about the animals living along the creek. These books became one of many hands-on exhibits in the museum.

As knowledge of our project spread, local and state agencies contacted us, including the Tennessee Valley Authority (TVA), the Soil Conservation District, the Chattanooga City Planner's Office, and local civic clubs. The Chattanooga greenway, "Riverwalk," designer spoke to the students and invited them to help in the design and construction of the Wolfcreek Creekwalk. A small group of students accompanied TVA biologists to conduct a fish survey in the creek. A web site was also created by the computer team.

As a culminating event, the museum was opened to the public one weekend, with over 200 visitors in attendance. During the next few weeks, each class in the school was given a tour of the museum, with eighth-graders acting as docents.

The following year, 1996-97, the students decided to form a legal non-profit corporation, calling themselves "Mission Environment, Inc." Our responsibility to keep the world as clean and natural as possible was the philosophy behind this environmental project, and the students expressed that theme in their slogan—"Teens Caring for the World." They elected officers and met regularly to formulate plans for their organization. They participated in the first Wolftever Creek Clean-up Day, which is part of a larger annual event, the Tennessee River Rescue.

The students spoke several times during the year at city commission meetings, the Kiwanis Club, local churches, a regional church leadership meeting, and the school board. They published a newsletter, *Wolftever Watch* (Appendix C), and were interviewed for local TV newscasts, as well as by a representative of the Tennessee State Service Learning Commission. Water testing, ecology, biology, and research into the history of the creek continued throughout the school year.

In May, my co-teacher and I, along with 12 students, were invited to make a presentation at an international wetlands conference in Alexandria, Virginia, to share how our efforts made an impact in our community. During this conference, our students had the opportunity to interact with other young people from around the nation who were involved in similar projects, as well as government officials, scientists, and concerned citizens from around the world. These students came back to school with an expanded vision of what

needed to be done to protect the environment.

From 1997-98, students continued the work of the corporation through the establishment of a board of directors. The board was made up of current seventh- and eighth-graders as well as students in a neighboring high school. Students in both schools were now working toward a common goal. One high school student came to the elementary school to teach journalism to the seventh- and eighth-graders as they worked together to produce the corporation newsletter, *Wolftever Watch*.

At the end of the year, each student designed and "published" a magazine on the computer which featured a topic related to Wolftever Creek and the activities along its banks, past and present. To locate information about their subject they conducted interviews, went on field trips, and did research on the Internet and at the university library. During the next 2 years students continued their participation in the annual creek clean-up, and, in April 1999, eighth-graders worked with city officials to plan the Wolftever Greenway Grand Opening Celebration. They assisted in the celebration activities and were recognized for their contributions to the establishment of the greenway during the opening ceremony.

The ME project won several awards during the 4 years it existed including the Hamilton County Soil Conservation Educator of the Year Award, the Southern Union Innovative Teaching Award, the Chattanooga Environmental Education Association Educator of the Year award, and the State of Tennessee K-12 Conservation Education Award.

Purpose of Study

In this study, the long-term effects of the ME project on participating students' environmental attitudes and behavior were evaluated by surveying a high-school senior class to determine students' current environmental attitudes and behavior. Of the 71 students surveyed, 28 indicated that they had been ME participants during their eighth-grade year (1996-1997). The survey data from the ME students were compared with the survey data from the students who did not participate. Additionally, through interviews, the assumption was investigated that the service-learning, experiential education, and outdoor education teaching methods used during the course of the project contributed to producing these long-term effects.

The purposes of this study, therefore, were (a) to determine if the ME students have more positive environmental attitudes and behaviors than those students who were not involved in ME, (b) to understand the perceptions of ME students concerning the way the project was taught, and (c) to provide a model for a middle-school environmental education project (an Innovation Configuration).

Significance and Benefits of Study

If the results of this study support the hypothesis that long-term positive environmental attitudes and behavior can be achieved by providing students with a curriculum that is based upon outdoor, experiential education and service learning, then these strategies should be considered when developing environmental education curricula for schools.

Since 1978, few American schools have established environmental education programs (Kirk, et al., 1997; Ramsey et al., 1992; Wilson & Smith, 1996). And, according to Leeming et al. (1993), few researchers have collected follow-up data concerning the long-term effects of environmental education programs on participating students' environmental behaviors. Leeming, Dwyer, Porter, and Cobern (1993) conclude that this trend is unfortunate because behavior change is ultimately the solution to environmental preservation. Their meta-analysis of the outcome research in environmental education showed that most of the studies reported only how an environmental education program affects knowledge and attitude, or both, but very few measured effects upon actual behavior.

Furthermore, according to Palmer (1999), research in environmental education must be at the heart of policy-making, and if the policy-making is to be successful, it must have a strong foundation of empirical data concerning the nature, emergence, and development of that attitude we call concern. She concludes that policy and practice in the field of environmental education must move away from a random approach to endeavors based on research. This study may help to provide some of these missing data.

This research could benefit several levels of educational organization:

1. It can be used to create a model for an environmental education project that will encourage teachers to involve their students in providing service to their communities. The model in this study has been developed in the form of an Innovation Configuration, which is one of the components of the Concerns-Based Adoption Model (Hord, Rutherford, Huling-Austin, & Hall, 1987). An Innovation Configuration is a process used to portray an

educational program in operational terms and represents the patterns of innovation described by teachers using the program in their classrooms.

2. Universities could be encouraged to incorporate instruction in outdoor/experiential education, service-learning-based environmental education in their teacher preparation programs.

3. School districts could be encouraged to include outdoor/experiential, service-learning-based environmental education in their core curriculum and to provide training and instructional support for such projects. School districts could also be encouraged to provide financial resources for environmental education.

Research Questions

In the course of the research, I addressed the following questions:

1. What effect did the ME project have on the students involved?
2. Were the stated teaching objectives of the program fulfilled?
3. What were the students' perceptions about the service-learning, outdoor-education approach used in this project?
4. Did they develop interests during their participation in the project that have led to career choices?
5. Did participation in the project lead students to greater involvement in their community?
6. What is the difference between ME students and non-ME students in their level of environmental knowledge and in their emotional responses to environmental issues?

7. Have the students continued to conserve natural resources?

Methodology

For this study, data were collected using two techniques. A survey was administered, and semi-structured interviews were conducted. The survey instrument, Measurement of Ecological Attitudes and Knowledge (MEAK), consists of five sections: an introductory Demographic Information section and four sections which measured (a) Attitude, (b) Behavior, (c) Affect, and (d) Knowledge. It was administered to the two groups of students, ME participants and non-ME participants.

Interviews were conducted with three ME students to determine their individual perspectives on participation in the project and on the learning methods used. Additionally, interviews were employed to collect data for a model of a middle-school environmental education project in the form of an Innovation Configuration.

Hypotheses

Based on the research questions and review of the literature, the following research hypotheses were formulated for this study:

Hypothesis 1: There is a statistically significant difference between ME participants and non-participants in total attitude scores as measured by MEAK.

Sub-Hypotheses 1.1-1.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in Section 1, Attitudes, of the MEAK survey.

Hypothesis 2: There is a statistically significant difference between ME

participants and non-participants in total behavior scores as measured by MEAK.

Sub-Hypotheses 2.1-2.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in Section 2, Behavior, of the MEAK survey.

Hypothesis 3: There is a statistically significant difference between ME participants and non-participants in total affect scores as measured by MEAK.

Sub-Hypotheses 3.1-3.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in Section 3, Affect, of the MEAK survey.

Hypothesis 4: There is a statistically significant difference between ME participants and non-participants in total knowledge scores as measured by MEAK.

Sub-Hypotheses 4.1-4.15: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 15 items measured in Section 4, Knowledge, of the MEAK survey.

Hypothesis 5: There is a statistically significant difference between ME participants and non-participants in total survey scores as measured by the self-administered survey for Measurement of Ecological Attitudes and Knowledge (MEAK).

Limitations

I have used a self-administered, self-report questionnaire to obtain data for this study. The employment of a self-administered, self-report questionnaire is a widely used procedure in survey research. However, there are specific limitations associated with this

method of data collection. First, self-report measures of attitude and affect can determine only how knowledgeable individual respondents are about their attitudes and emotional responses, and how willing they are to relate these. Second, the respondent may misinterpret a question, and the researcher is unable to assist in clarifying the item. A third assumption, which may also limit this study, is that the reported behaviors are not behaviors that have been observed by the researcher, but rather are students' perceptions of their own behaviors.

Another limitation in this study concerns common characteristics of the two sample groups. Because most of the students in the two comparison groups attended schools in a parochial system, it is assumed that they held basically the same philosophical views about the environment.

Finally, an inherent problem of causal-comparative research is that the information used may be incomplete. Lack of control over all variables makes causal statements very difficult to make. Therefore, since it is impossible to randomly assign subjects to the various groups, only probable cause and effect relationships can be established, and not actual ones (Best & Kahn, 1993).

Delimitations

The sample for this study was restricted to a senior high-school class; 28 of the students surveyed were involved in the ME project in the eighth grade, and 43 students who did not attend the same school during the eighth grade. The project was taught in a private school system which includes an elementary school, a high school (referred to as an

academy), and a university all located on the same campus. Students come to the elementary school and high school from several surrounding communities. A majority of the students who attend the campus elementary school choose to remain in the same school system and thus attend the academy, but some students move away or go to other schools. Therefore, to simplify the data collection process, the survey was given only to the ME participants who remained in the same campus school system, and were thus members of the same senior class.

Definition of Terms

For the purpose of this study, the following definitions were used:

Constructivism: A learning theory which holds that knowledge is based in the external environment and is independent of the learner's cognitive activities. Learning, therefore, occurs when students are able to make connections with personal experiences and the content they are studying.

Environmental Education: A process of developing awareness and concern about the total environment and its associated problems.

Experiential Learning: A teaching method which provides experiences for students that have real consequences in their world. It is learning that is real, practical, and concrete.

Outdoor Education: A method, or model of teaching, which uses the outdoors as a laboratory for learning.

Service Learning: A teaching method that helps students learn and develop by

providing opportunities for active participation in projects that meet actual community needs.

Outline of Dissertation

Chapter 1 includes an introduction, an historical background of the ME project, the purpose of the study, methodology, research hypotheses, significance and benefits of the study, and limitations of the study. Chapter 2 is devoted to a selected review of the literature pertaining to this study. The methodology which was used in this study is outlined in chapter 3. Chapter 4 presents an analysis of the survey and interview data, and a model, in the form of an Innovation Configuration, for a middle school environmental education project. Chapter 5 presents a summary of the study, conclusions, and recommendations.

The names of the project, the school, and its location have not been changed; however, the names of the students who were interviewed have not been included to assure anonymity of all responses and confidentiality of all records.

CHAPTER TWO

REVIEW OF LITERATURE

Overview

The purpose of this study is to examine the long-term effects of participation in Mission Environment (ME), an eighth-grade environmental education project. Chapter 2 presents a selected review of current literature examining the (a) history and definition of environmental education, (b) goals and objectives of environmental education, (c) theory of constructivism, (d) the role of experiential learning in environmental education, (e) the role of outdoor education in environmental education, (f) the role of innovative teaching strategies in environmental education, and (g) current studies concerning the long-term effects of environmental education projects on student attitudes and behavior.

History and Definition of Environmental Education

Before we begin to explore the teaching philosophy and methods used in the ME project, it is important to understand what the term environmental education means. Lau-Tsu, in 500 B.C. wrote, "In the end, we will conserve only what we love, we will love only what we understand, we will understand only what we are taught" (Lindenmeier, 1993, p. 2). Over the course of the past century, in the United States, conservation of natural resources has been taught utilizing various teaching models and in diverse contexts. It has

been labeled curricula by terms such as nature study, outdoor education, and environmental education. As a result of these varying contexts, many definitions and explanations for environmental education have evolved. I will briefly describe the interrelationship and history of these terms as they appear in the literature from the 18th century to the present.

In the 1700s, the hands-on study of nature was advocated in Europe by Jean-Jacques Rousseau, and later, by Johann Pestalozzi. Rousseau demanded a return to nature as an alternative to what he considered a depraved and artificial conventional civilization (Pulliam & Van Patten, 1999). His philosophy was founded on the belief that nature and experience were educationally connected. Rousseau's ideas influenced Pestalozzi, who held that "sense impression of Nature is the only true foundation of human instruction, because it is the only true foundation of human knowledge" (Ozmon & Craver, 1999, p. 76). Pestalozzi's curriculum included teaching such skills as gardening and spinning, and correlating subjects, such as arithmetic, with nature, by having children apply numerical value to objects.

One of the earliest examples of environmental curricula in the United States was the nature study movement, which became a part of formal education in 1891 when Wilbur Jackson wrote *Nature Study for the Common Schools*. His contributions to the field of science study include inquiry and discovery, with first-hand observation and experience (Swan, 1975).

During the 1930s the United States suffered the disastrous "Dust Bowl," which gave rise to the term *conservation education*, the goal of which was to alert Americans to problems in the environment and to the necessity of saving natural resources (Nash, 1976).

This focus on education about the environment was initiated by federal, state, regional, and local resource management agencies.

It was also during this period that the Progressive Education Movement became a significant strand in the formation of the environmental education movement. John Dewey's philosophy defined learning as holistic and child-centered. The focus of progressive education was learning by doing, which included learning about the environment while in the environment. The emphasis was on integrated, interdisciplinary education that was more than a preparation for life—it was an integral part of life (Dewey, 1938).

After World War II, many factors contributed to a need for environmental education, including a stronger role for science and technology in education, improvements in global communication, and an increase in world population. Also, in the 1950s the school-camping movement grew in popularity. This program would eventually become known as “outdoor education,” and its earliest authority was L. B. Sharp (1943). His philosophy was to teach those subjects outdoors that are best learned outdoors, and to teach those subjects indoors, that are more appropriate there. Sharp's definition of outdoor education implies that it is not a separate discipline, but rather a method of teaching content from several areas of curriculum, outside the classroom. He further described outdoor education as a logical method of learning that is natural, simple, and direct (Rillo, 1985).

Rachel Carson's book, *Silent Spring*, published in 1962, is commonly identified as the clarion call which triggered the environmental movement of the 1960s and 1970s

(Smith, 1992). In her book, Carson alerted the world to the dangers of pesticides, particularly DDT, and the ecological disaster which would result from their continued use. Based upon her research, she was convinced that DDT brought on the “age of resistance,” and that chemical treatment created a vicious cycle that, once started, could not be stopped (Carson, 1962). Awareness of human impact on the fragile environment became even more evident to Americans as they saw for the first time, in 1969, a view of the whole Earth, broadcast from space. One year later, in 1970, the first official “Earth Day” was recognized (Bones, 1994).

Environmental education, in its present form, grew rapidly during the next two decades. Perhaps the first concise definition of environmental education was developed in 1969 by Dr. William Stapp of the University of Michigan: “Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution” (Stapp, 1969, p. xi).

The Environmental Education Act (P.L. 91-516) was signed into law in 1970 by President Richard Nixon. The Act defined environmental education as “the educational process dealing with man’s relationship with his natural and manmade surroundings, and includes the relation of population, conservation, transportation, technology, and urban and regional planning to the total human environment” (Disinger & Monroe, 1994, p. 11).

Goals and Objectives of Environmental Education

The events which led to the development of environmental education in the United

States were unique, but similar ecological dilemmas were being recognized around the world. The United Nations Educational, Scientific and Cultural Organization (UNESCO) coordinated a series of conferences from 1974-1978 to establish an international definition of environmental education. As alluded to in chapter 1 of this dissertation, the Tbilisi Conference in the USSR laid the groundwork for current environmental education goals. The following description and goals for environmental education were agreed upon in 1978:

Environmental education is a process of developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, skills, attitudes, motivation and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones.

The Tbilisi agreement further stated that:

Environmental education, properly understood, should constitute a comprehensive lifelong education, one responsive to changes in a rapidly changing world. It should prepare the individual for life through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given to ethical values. (UNESCO, 1978, p. 24)

The National Environmental Education Act of 1990 reaffirmed the purpose of the 1970 National Environmental Education Act. It focused on schools as the appropriate place for teaching environmental education, but also recognized the importance of non-formal avenues such as the community and the workplace (Disinger & Monroe, 1994).

After the Tbilisi Conference, many of the educational programs instituted in schools lacked a clear direction and did not meet the established objectives (Kirk et al., 1997).

Hungerford, Peyton, and Wilke (1980) responded to this problem by publishing *Goals for*

Curriculum Development in Environmental Education. Their framework for developing curricula included four levels which were consistent with the Tbilisi goals:

Level 1: Ecological Concepts includes a broad framework of environmental science and ecological concepts, such as population dynamics, biogeochemical cycling, and abiotic influences. Other educators may add companion goals in political, economic, psychological, and social concepts (p. 43).

Level 2: Conceptual Awareness builds an understanding of how individual and collective behavior influences the relationship between quality of life and quality of environment, as well as how human behavior results in issues that must be resolved through insightful problem solving (p. 44).

Level 3: Issue Investigation and Evaluation develops the knowledge and skills needed to investigate environmental issues and to evaluate alternative solutions for remediating them (p. 44).

Level 4: Environmental Action Skills develops the knowledge and skills needed to take positive action to resolve environmental issues (p. 44).

According to Disinger and Monroe (1994) research has consistently shown that behavior change does not occur if students are exposed only to the first two levels. Students need to be exposed to all four areas for significant behavior change. They also report that the quality of students' environmental action also seems to improve when they are afforded opportunities to experience direct involvement in their own investigations. He concludes that more emphasis needs to be placed on the development and implementation of curricula that emphasize the full range of goals, and particularly levels 3 and 4.

The goal of environmental education is to help students become environmentally aware, knowledgeable, skilled, dedicated citizens who are committed to work, individually and collectively, to defend, improve, and sustain the quality of the environment on behalf of present and future generations of all living things. (Engleson & Yockers, 1994, p. 14)

From this goal statement Engleson and Yockers have extracted five subgoals which

include (a) perceptual awareness, (b) knowledge, (c) environmental ethic, (d) citizen action skills, and (e) citizen action experiences.

The National Science Teachers Association's (NSTA) *Criteria for Excellence*

(1990) expands these same concepts for excellence in environmental education:

Goal: To develop and practice creativity and critical thinking along with values analyses. Teachers and learners will search for alternative solutions to environmental issues and evaluate the ethical, social, ecological, and economic costs and benefits of alternatives.

Curriculum:

1. Provides activities and information in which people interact with the environment.
2. Develops in the students the intellectual tools to effectively explore the world around them.
3. Directly involves students in investigating the world around them and their relationship to it.

Instruction:

1. Fosters open minds and the generation and examination of alternatives.
2. Stimulates and fosters creativity and critical thinking.
3. Respects the social, intellectual, and developmental maturity of learners.
4. Links science with other areas of intellectual and emotional activity.
5. Provides opportunities for students to be involved in environmental activity at an appropriate level of challenge; hence, fosters a growing sense of confidence that groups and individuals can positively affect the environment.
6. Relates the components of the ecosystem to our health, well-being, and potential for development. (NSTA, 1990, p. 26)

The *National Science Education Standards*, developed by the National Research Council in conjunction with the National Committee on Science Education Standards and Assessment (National Academy of Sciences, 1998), include environmental education in the content standards for "Science in Personal and Social Perspectives" for all grade levels, K-

12. Additionally, this document confirms the idea that changes are necessary in the educational system to support quality science teaching, including environmental education. These changes are major ones which revolve around the concept that student learning, or acquisition of knowledge, is directly related to teaching methods. The recommended changes include, among others, more emphasis on integrating all aspects of science content, implementing inquiry, supporting a classroom community with cooperation, and conducting investigations over extended periods of time.

The range of learning outcomes for environmental education, as suggested by these various goals and objectives, demands the use of methods that are far more involved than traditional information-processing teaching. The challenge is to provide students with a continuum of experience that incorporates outdoor education and learning with hands-on activities. Direct experiences in the community beyond the classroom can greatly enrich subject matter that has been “taught” in school and make it more profound (Hammerman, & Hammerman, 1994).

Environmental education provides such opportunities by sharpening observation and strengthening problem-solving skills. Likewise, teaching about the environment is most effective if linked with community service because it is directed to tangible results (Hudson, 2001).

Currently, environmental education is being taught in a variety of settings, using numerous strategies and methods. And while the goal for environmental education has been refined over time, the major principles and focus remain the same—to build an environmentally responsible community of citizens (May, 2000). Although environmental

education has been viewed by some educators as an integral part of a complete education, it is treated by others as mostly an enrichment of the science program (Simmons, 1989).

However, Nelson (1993) discovered from his survey, that educators viewed environmental education as an interdisciplinary enterprise which must include knowledge from all subject areas. He concluded that environmental education should not be perceived as something to be added to the curriculum, but rather it should be a way of providing meaningful content to the current school curriculum.

The goals of environmental education have been established by governments and experts in the field. The challenge is to determine the most effective way to achieve these goals in the schools. An investigation into current learning theories and teaching practices may provide some of the answers. The learning theory underlying many current environmental education projects is constructivism. Experiential learning and outdoor education are often the teaching methods used. Furthermore, several teaching innovations may be embedded in outdoor education, including cooperative learning, service learning, and participatory action research, among others (Knapp, 1996; Mordock & Krasny, 2001).

Theory of Constructivism

Precursors of the theory of constructivism are pragmatism, existentialism, phenomenology, hermeneutics, and some modes of idealism. Constructivism also draws heavily on psychological theory developed by Jean Piaget, Lev Vygotsky, Jerome Bruner, Howard Gardner, and Nelson Goodman (Ozmon & Craver, 1999).

To understand the theory of constructivism, it is helpful to see its relationship to

two other common learning theories: behaviorism and information processing. Behaviorism is the theory that behaviors are acquired through simple conditioning or learning. This theory focuses on the teacher's function of observing student behavior and the environment, which allows for predicting and controlling behavior in a classroom (Jacobson, 1999).

Information processing theory is the belief that a student's behavior is always based on cognition. It is the result of knowing or thinking about the situation in which the behavior occurs. Teachers therefore are concerned with the organization of knowledge, information processing, and decision-making, which are behavioral aspects of the cognitive realm (Jacobson, 1999).

Constructivism, on the other hand, holds that knowledge is based in the external environment and is independent of the learner's cognitive activities. The teacher's role, therefore, is to provide students with opportunities "to construct useful knowledge as they engage in purposeful activity" (Jacobson, 1999, p. 31). Some typical characteristics of constructivist teachers are: (a) encouraging student autonomy and initiative, (b) using raw and primary sources: students' personal hands-on experiences with a subject and interactions with experts, (c) allowing students to drive lessons; adapting instructional strategies when necessary, (d) encouraging students to engage in open dialogue with each other and the teacher, (e) asking open-ended questions, (f) seeking elaboration of student answers and allowing wait time after asking questions, and (g) providing time for students to develop their own knowledge (Brooks & Brooks, 1993).

The constructivist approach has as its focus activities that encourage

students to seek solutions and form knowledge (beliefs) rather than to repeat ready-made solutions to problems and verbalize particular constructs without really understanding or internalizing them. (McNeil, 1999, p. 4)

Constructivist learning, therefore, happens when students are able to make connections with personal experiences and the content they are studying (Brooks & Brooks, 1993; Henderson, 1996). This theory also suggests that students should participate in experiences that accommodate these ways of learning. Examples of these experiences include: problem-based activities, independent student projects, inquiry learning activities, dialogues with peers and teachers to make sense of the subject matter, exposure to many sources of information, and diverse ways for students to demonstrate what they have learned.

The appearance of constructivism in the classroom is not a unique set of instructional methods incorporated into traditional teaching techniques, but rather it is “a culture—a set of beliefs, norms, and practices that constitute the fabric of school life” (Windschitl, 1999, p. 752).

Many of the activities included in early environmental education curriculum guides, and in most current curriculum guides, are based on the constructivist technique of student-centered learning in solving real-life problems (Klein & Merritt, 1994). Some examples of these guides include: Virginia’s State Department of Education *K-12 Environmental Education Guide* and *Project Learning Tree* (American Forest Foundation, 1995), both developed in the 1970s.

The goal for *Project WILD*, produced by the Western Regional Environmental Education Council (WREEC) and first published in 1983, was “to assist learners of any

age in developing awareness, knowledge, and commitment to result in informed decisions, responsible behavior, and constructive actions concerning wildlife and the environment upon which all life depends" (WREEC, 1983 p. viii). *Project WET* (The Watercourse and the Council for Environmental Education, 1995) is a collection of water-related activities incorporating laboratory investigations, group discussions, and involvement in community service projects.

Four major components of constructivism appear to be necessary for meaningful environmental education lessons: (a) the introduction of a real-life problem which students need to solve, (b) student-centered learning which is facilitated by the teacher, (c) cooperative group interaction, and (d) assessment which is authentic and provides a clear demonstration of student progress (Klein & Merritt, 1994).

If these major components are present in environmental education lessons, students will be actively engaged in such tasks as experimentation, investigation, observation, and discussion. Teachers will have created a constructivist learning environment in which students are able to choose their own method of problem-solving and have access to the resources and materials needed to arrive at their solutions. The physical environment will be conducive to the construction of knowledge, and teachers, as facilitators, will be able to assign appropriate tasks, provide guidance when needed, and support students in their interactions with one another (Chaille & Britain, 1991).

Role of Experiential Learning in Environmental Education

According to the National Society for Experiential Education (NSEE, 1997),

experiential education is a reactionary philosophy which originated during the late 19th century to counter the prevailing industrial model of education. Furthermore, it has since been associated with and articulated in a variety of teaching models including, but not limited to, cooperative learning, outdoor education, and service-learning.

The essence of the theory can be traced to Aristotle, who argued that “knowledge is obtained through tuning in to the soul, to our ideas, and testing out those ideas through our experiences” (Thayer-Bacon & Bacon, 1998, p. 40). He hoped that by using both our ideas and experiences, we would be led to knowledge. C. S. Pierce, a philosopher of the 19th century suggested that because human beings are imperfect and incomplete, who cannot trust their own ideas, they need to seek solutions in a community of rational inquirers (Thayer-Bacon & Bacon, 1998).

In 1938 John Dewey defined experiential education as his “Theory of Experience” (Dewey, 1938). He argued that traditional, classroom-based education was predicated upon

dualisms of mind and body, mind and world, and on deductive logic that works from the general to the particular. It assumes the ignorance of the learner and the wisdom and authority of the teacher and is premised on belief in bodies of knowledge or “disciplines” that the student should acquire. (NSEE, 1997. para. 4)

Dewey (1938) stated that traditional education was essentially undemocratic, and separates experience from learning. He expanded his definition of educative experiences to include those experiences during which an individual grows intellectually and morally, in which the larger community benefits from the learning, and in which experience leads to further growth. He delineates the responsibilities of the educator in creating the conditions

for these experiences. It requires the educator to possess knowledge of the students, understanding of the kinds of experiences that will help them learn, and the ability to respond to situations that may arise during the course of the experience (knowing how to use the teachable moment). Various fields have emerged as a result of Dewey's philosophy. Outdoor education, service-learning, cooperative learning, and internships are all examples of experiential learning developed to suit students with particular purposes (NSEE, 1997).

Other writers associated with experiential education are Paulo Freire, and David Kolb, who incorporated Dewey's basic philosophy in more recent years. Freire's ideas on adult education as a way for oppressed people to claim power are expressed in his *Pedagogy of the Oppressed*. In this treatise he called for "problem-posing education," in which "people develop their power to perceive critically the way they exist in the world with which and in which they find themselves" (Freire, 1970). Kolb (1984) was even more explicit in his well-known *Experiential Learning* when he suggested that learning is the act of transforming experience into knowledge.

The Civilian Conservation Corps of the 1930s and later, such programs as Outward Bound and the Peace Corps are early examples of John Dewey's philosophy put into practice. More recent examples of experiential education can be seen in the resurgence of federal and school interest in "service learning" and "school to work" programs.

The Audubon Expedition model, first developed in the 1970s, and still active today, is an adult environmental education program. Students create a traveling, experiential learning community for a 10-week focused study. Some students go on to

apply their learning through career and lifestyle choices. The Audubon Expedition model enables students to perceive the interconnectedness of theory to real-life practice, and they leave the program as informed citizens intentionally seeking social reform (Wittmer & Johnson, 2000).

Authors Peggy Walker Stevens and Richard Anthony in their (1992) article, "Changing Schools through Experiential Education," conclude that experiential education is a teaching method which provides experiences for students that have real consequences in their world. In the process, students are able to reflect on their experiences, which leads to the development of new skills, new attitudes, and new theories or ways of thinking (Kraft & Sakofs, 1988). According to Adolph Crew (1987), when students are provided real, practical, and concrete experiences, the knowledge thus obtained becomes permanent and is transferable to future applications.

According to Rick (1998), another term for experiential education is authentic learning which is predicated upon using real-world problems as the basis of student activities. Students actively solve problems in collaborative groups. Authentic learning is driven by "essential knowledge" that is meaningful to students, and this knowledge is ensured by engaging students in real issues that deal with human commonalities. "The curriculum looks less like a compilation of discrete building blocks and more like a continuous ascending spiral in which each experience builds on previous ones as students increase their understanding and improve their skills" (p. 391).

The foundation of experiential education is holistic and integrative, premised on making meaning out of experience. Today, these principles are widely used in

organizational development and training, particularly in team building, problem solving, and conflict resolution. These same principles can be identified in other areas such as outdoor education, apprenticeship and internship programs, as well as laboratory and other experimental formats (NSEE, 1997).

According to the NSEE Foundations Committee statement (1997), experiential education differs from traditional textbook-based learning, in that knowledge is constructed by people, individually and in groups, as they experience the world around them. An important component of this education is reflection or dialogue, which unifies the experience for the individual and the community. Only experience that has been reflected upon, in fact, can be considered learning. And the reflections should lead to new concepts and theories which can be tested by further experiences. Every student will need to learn how to learn and develop a repertoire of such constructed meanings. Experiential learning thus provides solid structures for compiling these repertoires of knowledge (Miller, 2001).

Recent neurological research has documented the interconnectedness of learning. Daniel Goleman (1995) documents this phenomenon in his book, *Emotional Intelligence*, in which he describes the ways past experiences affect our responses to current experiences. From his studies, physiological evidence supports the idea that we learn from experience, and this factor must be considered as learning activities are designed for our students.

Experiential education is student-centered, and thus the role of the teacher can be compared to a shepherd. Just as the shepherd must guide and protect his sheep, so the experiential educator assists in the development of new ideas by drawing on the resources

of the group (guiding) and by providing a safe learning environment (guarding) (Woods, 2001).

There are several reasons why experiential education may be an important part of education in the 21st century. Besides the pressing environmental problems, today's youth will be working in a job market that is markedly different from that of their parents. "They will be expected to be not only literate in language, science, and math, but they must be information literate, which includes the ability to evaluate, analyze, and apply critical thinking to the use of information" (Breivik & Jones, 1993, p. 28). They must also have the ability to work with others on problems, and be able to cope with open problem situations, because most real-world problems do not fit neat formulas (American Association for the Advancement of Science, 2002; National Council of Teachers of Mathematics, 1989).

Changes in the economy are producing social changes, including a downward social mobility. More parents are working and more families are disrupted by divorce and violence. These factors, along with many others, have contributed to students' increasing levels of negative self-worth, which in turn lead to increased school drop-out rates and substance-abuse problems. Education must not only provide literacy training, it must also help to develop a culture of responsibility, otherwise, according to Hersh (1994), we will become "a nation of individuals who cannot read or write well, with no sense of major human questions, who cannot think critically or show interest in learning and who are unable to act responsibly in a diverse democratic society" (Hersh, 1994, p. 13).

Experiential education is seen by many as one of the methods that may be needed

during this present age of major social change from an industrial to a knowledge-based society. A National Middle School Association (NMSA; 2001) task force delineated what it considered key learning experiences for middle-school students and stated that learning experiences for young adolescents should:

1. Address their varied intellectual, physical, social, emotional, and moral development.
2. Help them make sense of themselves and the world about them.
3. Be highly integrated and connected to life.
4. Include their questions, needs, developmental issues, and ideas.
5. Involve them in rich and significant knowledge about the world.
6. Open doors to new ideas that evoke curiosity, the desire to explore, and at times, awe.
7. Challenge students and encourage them to take maximum advantage of educational opportunities.
8. Develop caring, responsible, and ethical citizens who practice democratic principles.
9. Emphasize collaboration, cooperation, and community
10. Encourage and challenge students to give their best efforts as life-long learners and doers
11. Above all, seek to develop good people, fostering caring for others, democratic values, and moral sensitivity.

The NMSA position paper adds that they advocate learning experiences which:

1. Value the dignity and diversity of all individuals.
2. Allow students to learn and express themselves in a variety of ways.
3. Use the full range of communication skills and technologies in purposeful contexts
4. Engage students in problem-solving through a variety of relevant experiential learning contexts.
5. Involve students in meaningful service which encourages them to make a difference in the world around them.
6. Involve students in setting goals, planning, and assessing their own learning.
7. Include continuous, authentic, and appropriate assessment of students' progress.

8. Acquisition of desired behavioral attributes.

To fulfill these goals, students need opportunities to experience real-life learning—learning that is attained, not by sitting in desks in a classroom, but by working and helping others in the world outside the classroom. If students are given the freedom to devise their own learning projects, they frequently develop exciting experiences from which they profit substantially. Learning becomes an adventure as they become searchers after knowledge, rather than passive recipients (Rogers & Freiberg, 1994).

Not everyone, however, is as supportive of experiential education. Critics dislike a “process orientation” in favor of the idea that knowledge is fixed and morals are absolute. However, developmental theorists, including Jean Piaget, William Perry, and Lawrence Kohlberg, agree that how individuals make meaning of their experiences in the world creates their cognitive and moral development (NSEE, 1997).

There are a number of misconceptions of experiential education that exist among educators. These misconceptions and NSEE’s responses follow:

1. Some critics see experiential education as deficient in academic rigor. This criticism may be derived from the fact that it does not begin with a body of knowledge, but rather with the experiences and the questions of its students. If done carefully, experiential education approaches involve careful observation, critical thinking, dialogue, and ethical experimentation.

2. Others believe that there is too much emphasis on feelings and not enough on content or ideas. The goal of experiential education is to teach and learn holistically, not to compartmentalize affective and subjective ways of knowing. To become equally aware of

the world and of oneself requires a constant interaction between the two.

3. Some critics see experiential education as disorganized and chaotic. It is true that experiential education can be messy and non-linear, but more often than not, when this criticism is expressed, observing teachers really mean that they fear they will have less control.

4. Concern has also been voiced that experiential education is too time consuming. New processes always take more time at the beginning. Much discussion and agreements among several individuals and organizations must necessarily occur at the outset. But experiential education is increasingly efficient over a period of time (NSEE, 1997).

In spite of these concerns, according to Anne Lieberman (1995) in an article in *Phi Delta Kappan*, “what everyone appears to want for students [is] a wide array of learning opportunities that engage students in experiencing, creating, and solving real problems, using their own experiences, and working with others” (p. 591).

Finally, Hicks (1993) has found that educators can counter the effects of negative peer pressure and inconsistent messages about the state of the environment if they offer real experiences in solving real environmental problems rather than using hypothetical examples.

Role of Outdoor Education in Environmental Education

With a foundation of constructivism and experiential education, the “tool” often used to deliver (teach) environmental education is outdoor education. The definitions and descriptions of outdoor education can refer to place, topic, purpose, or combinations of all

three (Ford, 1986). Outdoor education has also been described as a method (experiential education), a process (discovery through the senses), a discipline (ecology), and a reason (advocacy groups). Besides the obvious definition of learning out of doors, outdoor education can also refer to learning/education about ideas, objects, and relationships which reside out of doors (Priest, 1990).

Other terms used interchangeably with outdoor education are: conservation education, resident outdoor school, outdoor pursuits, adventure education, experiential education, and environmental interpretation. The purpose of outdoor education has been more recently defined as using the outdoors as a laboratory for learning (Hammerman et al., 1994).

The terms environmental education and outdoor education are often used interchangeably, but Phyllis Ford (1986) in her article, "Outdoor Education: Definition and Philosophy," describes the philosophy held by many in the field, by differentiating the terms:

In its most inclusive sense, however, outdoor education is education about the outdoors and its many ramifications, in the outdoors, for the purpose of developing knowledge, skills and attitudes concerning the world in which we live. . . . In the broadest terms, the topic is the interrelationship of the human being and the natural resources upon which societies depend, with the goal of stewardship in mind. (p. 5)

Ford continues by stating that environmental education is "all-encompassing," while outdoor education is sometimes understood to relate to natural resources but does not embody the concept of the world environment. She concludes that many people think of outdoor education in its broadest sense and therefore prefer the term

outdoor/environmental education. For the purpose of this study, I will use the term “outdoor education” as a teaching model and “environmental education” as a discipline.

Is environmental responsibility best taught in the out-of-doors? Outdoor activities do produce an initial sensitivity to the environment and an increased understanding of the interconnectedness of all parts of the ecosystem which lead to environmental activism. And, furthermore, outdoor activities appear to motivate students to learn about the environment. The programs most likely to change attitudes and behavior toward environmental issues involve concrete, environmentally positive, action-oriented experiences. Long-term involvement, follow-up, support and positive reinforcement by role models also contribute to the success of these experiences (Matthews & Riley, 1995).

In a survey conducted by the National Environmental Education and Training Foundation with funding from EPA, students in Grades 4-12 were questioned about their environmental concerns, education, and action. Fifty-six percent of the students surveyed indicated that the key to getting youth involved in environmental issues was to get them close to nature (Rockland, 1995).

Ramsey and Hungerford (1989) conducted an experimental study on the effects of an outdoor education curriculum package that used environmental action training on seventh-grade students. After 18 weeks, significant changes in environmental behavior and knowledge of possible solutions to environmental problems were reported by the experimental group. The control group, which received standard textbook instruction, reported no such changes.

When students learn outdoors, the community becomes the classroom. Outdoor

education fosters “connected knowing” (Gardner, 1993). Students begin to view education as an integral part of life rather than an autonomous pursuit. As stated earlier, John Dewey was an early proponent of this approach to education. For example, he envisioned civics education as an opportunity for students to practice civic responsibility in the world around them through experiential learning, or learning by doing. The connectedness that students attain with the environment through outdoor education flows over into an awareness of their relationship with others in the community (Fouhey & Saltmarsh, 1996).

Research conducted by Howe and Disinger (1988) determined that outdoor experiences made a significant impact on student behavior and attitudes concerning environmental conservation issues. They reported that the most successful outdoor strategies were case studies, field trips, community inventory projects, and community action projects.

The authors of *Project WILD* (WREEC, 1992) have stated that “effective learning is often heightened in natural settings” (p. 344). The joy of discovery, which often is absent in the traditional classroom, can be reawakened when the classroom is extended into the outdoors. Furthermore, if education is life, it cannot be separated from the setting in which life happens. “The dualisms of school and society and the school in the community cannot be separated. They are interrelated—fused together in an inseparable bond” (Hammerman et al., 1994, p. 26).

Research has supported the positive value of field instruction upon the affective realm (Bogner, 1998; Ignatiuk, 1978; Kern & Carpenter, 1984). Outdoor activities can stimulate environmental education by helping students develop an empathetic relationship

with nature and by learning the strategies to protect it (Palmberg, 2000). Furthermore, cognitive abilities seem to be enhanced through outdoor education when experiences are effectively planned and managed (Disinger, 1987).

Outdoor education can be considered a tool, or a method, to integrate many subject areas when students explore, investigate, and discover the world as a whole—not in separate subject categories. It can enhance subject matter that has been “covered” in the classroom and connect it with real life (Hammerman et al., 1994). Classroom schedules divide life into learning time and non-learning time, when life itself is actually constant learning.

“Perhaps one of the greatest lessons of the outdoor classroom is this: we can learn everywhere and we can learn with and without books” (Link, 1981, p. 3).

There is no more highly stimulating setting than the outdoor classroom. This classroom is equipped with expandable walls that extend as far as the learner’s legs want to carry them. The floor varies from locale to locale—sometimes rock or water and sometimes field or forest. Its ceiling, too, is varied with ever changing shapes. . . .No school has ever contained the books, maps, or charts to rival the vividness of the real world. (Hammerman et al., 1994, pp. 14-15)

Role of Innovative Teaching Strategies in Environmental Education

In December of 1997, an international conference was convened in Thessaloniki, Greece, to celebrate the 20th anniversary of the Tbilisi Doctrine. A charter document, “The Thessaloniki Declaration,” was written to reorient education for sustainability in the 21st century. This document outlines several points of affirmation regarding environmental education and also offers 14 recommendations for further implementation. One of those recommendations is that special emphasis should be given to the identification and sharing

of innovative practices in the teaching of education for environment and sustainability (Knapp, 2000).

How do methods of teaching impact the results of environmental/outdoor education projects? In his book, *Just Beyond the Classroom*, Charles Knapp (1996) asserts that effective outdoor education programs should be interdisciplinary, involve service learning, use problem-based learning methods, be focused on the community, allow collaborative interactions, and include time for reflection.

Goodlad (1984) in his landmark book, *A Place Called School*, described exciting and effective learning as approaches that make subject matter relevant to students, with students setting their own goals and engaging in activities that employ all the senses. He advocated giving students opportunities to relate knowledge to experiences or to actually use the knowledge. This picture was in contrast to the prevailing classroom scene with students sitting in rows, passively listening to lectures.

The importance of using a variety of teaching strategies with a group of students has been substantiated by recent brain research revealing new conceptions of intelligence. Plato's unitary concept of the mind is being replaced by the idea that the mind is organized into relatively independent realms of functioning (Feldman, 1980, 1986; Fodor, 1983; Gardner, 1993).

Another concept coming from brain research is that, excluding exceptional populations, all humans possess certain basic abilities in each of the eight or more intelligences identified by Howard Gardner (1993). These intelligences are recognizable in different settings, at different points in development. It is during adolescence and

adulthood that the intelligences are expressed through the choice of vocational and avocational pursuits.

An important implication of these findings for education is the necessity of providing the optimum learning environment for each individual. Since classrooms are composed of many different students possessing varied sets of intelligences, a variety of learning opportunities should be provided. "Once we move away from uniform schooling, we need models that take seriously individual profiles of intelligence and seek to maximize the educational achievements of each person" (p. 72).

Other implications which have been espoused by brain-based education advocates include: curriculum integration to provide meaningful connections, curriculum structure and content matched to different cognitive abilities, and learning environments that provide familiarity as well as challenge and discovery (Ellis, 2001).

This view stands in contrast to the uniform curriculum of traditional schooling in which the goal for each student was to master a particular body of knowledge which was often dissociated from real-world contexts. An individual-centered curriculum, the goal of progressive education, fosters the development of each person's full potential within his/her own learning schema. One way this goal can be achieved is by providing constructivist classrooms where students are allowed to pursue their areas of interest via hands-on projects and field experiences (Gardner, 1993).

The following section of the literature review deals with three innovations often integrated in environmental education—cooperative learning, service learning, and action research.

Cooperative Learning

In the real world, one's ability to communicate effectively and work collaboratively is critical to a successful outcome. "Given the reality of the job-world, it is incumbent on schools to provide cooperative, interdependent experiences in order to provide students with the interpersonal skills they will need for positive participation in economic life" (Kagan, 1994, p. 1:1).

Cooperative learning has been defined by Cruickshank, Bainer, and Metcalf (1999) as an instructional procedure whereby students work together in groups to accomplish a task and are rewarded for their collective accomplishments. Its purpose is to help students learn in comfortable, non-threatening environments (Johnson, Johnson, & Holubec, 1991; Slavin, 1990). Teachers must create classroom environments in which all students have equal opportunities to learn (Leonard & McElroy, 2000).

Johnson, Johnson, & Holubec (1990) have defined several skills to be acquired from cooperative learning groups: positive interdependence, face-to-face promotive interaction, individual accountability, interpersonal and small group skill development, and group processing skills. Schools must teach teamwork, because in the real world of work, employers expect their employees to possess the skills necessary to interact effectively with their colleagues. Employees are expected to know: (a) how to encourage others to cooperate, (b) how to cope with complex power and influence issues, and (c) how to solve interpersonal conflicts within the workplace.

Because our students live in a complex, interconnected world, there is no division

between local and international problems. They must learn how to communicate, cooperate, and resolve conflicts in multi-cultural settings, and they must be able to adapt to a rapidly changing world. "The ability of students to work collaboratively with others is the keystone to building and maintaining the caring and committed relationships that largely determine quality of life" (Johnson et al., p. 18).

Current research generally supports the idea that cooperative groups generate the energy that results in improved learning (Joyce, Weil, & Showers, 1992). Additional benefits include improved cognition, focus time on task, long-term retention of learning, higher self-esteem, acceptance by peers, and positive interactions between students and teacher (Tomlinson, Moon, & Callahan, 1997). Of all of the educational innovations researched and reported in *Research in Educational Innovations* (Ellis, 2001), cooperative learning has the largest empirical base.

Students who have experienced cooperative learning structures in the classroom more often choose adaptive cooperative strategies in working with others (Kagan, 1994). According to Carmen Stearns (1999) when cooperative learning was implemented in her school, the final result was a transfer of love and respect for each other, learned in the classroom, into the community.

The implications for the field of environmental education are enormous. In the ecological crisis where competition puts stress on our limited natural resources and endangers wildlife, learning how to cooperate is a future survival skill that schools must practice and teach (Pulliam & Van Patten, 1999).

Service Learning

During the last decades of the 20th century, there was a decline in willingness among young people to participate in service to the community or the nation (Garman, 1995). A 1998 report of the National Commission on Civic Renewal (Patrick, 1998) states that in a time when civic action is desperately needed in America, we are in danger of becoming “a nation of spectators.”

As reported in People for the American Way (1989), the five major reasons for this reluctance to serve are a lack of time, lack of parental encouragement, lack of role models, lack of experience necessary to perform the service, and, most significantly, students are not asked to serve. According to Hope (1999) service learning is a powerful instructional method that teaches students in their communities how to serve their communities.

Proponents of service learning believe that negative attitudes would be eliminated if opportunities for service were provided for young people in a controlled and meaningful environment (Garman, 1995). Many schools have addressed this need with the inclusion of service-learning experiences in their curriculum. It has been defined by Dunlap, Drew, and Gibson (1994) as an educational strategy which gives young people opportunities to serve their communities while enriching their academic learning, and encouraging the development of personal growth and citizenship skills.

Service learning activities involve programs and projects in which students, teachers, parents, and community members work collaboratively to benefit the local community (Koliba, 2000). Another important aspect of service learning is its benefits in the field of vocational and career education. Students have opportunities to establish a

network of contacts as they pursue future career experiences (B. Brown, 1998).

Uzzell (1999) concludes that the “authenticity principle” is central to the development of action competence. He believes that the school should participate as much as possible in the life of the local community. In other words, a critical factor in teaching students action strategies to effect environmental change, is for school education to get as close as possible to the reality that awaits pupils after school. In middle schools with a service-learning component, the community becomes a learning laboratory (Schukar, 1997).

Hwang, Kim, and Jeng (2000) concluded that to enhance positive environmental behavior, educators need to focus more on developing programs that emphasize critical thinking skills and equally as important, they should provide opportunities to apply the action skill that has been learned.

Uzzell (1999), proposes a model for environmental education called the “dialogue model.” In this model, the barriers between the school and the community are permeable. Community members are in the school and students are active in the local community. The author reports on two European projects, the QUARK program in Denmark and the Children as EcoAgents project in Finland. The goal of these two programs is for schools to become agents of social change in their communities.

In the United States, the Foxfire Curriculum, the Common Roots Program, and the Ecoliteracy Project are examples of this same “dialogue model.” Bowers (1995), regards them as successful attempts to involve students in the issue of ecological sustainability by studying the local culture. All three programs link communities with schools through

service learning.

Service learning is a form of experiential learning because it is a conscious application of students' experiences integrated into the curriculum. John Dewey (1938) wrote that an experience is qualified as educational to the extent that it contributes to the student's internal and objective development. He defines such an experience as both a process and an outcome.

The National and Community Service Act of 1990 established the following criteria for service learning:

1. It is a method in which students learn and develop by active participation in experiences that meet actual community needs.
2. These experiences are a collaboration of school and community and are integrated into the students' academic curriculum.
3. The service learning experiences extend student learning beyond the classroom by developing a sense of caring for others.

From a study of successful service learning projects, Garman (1995) concluded that the components of successful service learning programs include:

- (a) clearly articulated goals that stand a reasonable chance of being accomplished, (b) projects of real consequence to the community, (c) student tasks involving real responsibility and trust, (d) initial and ongoing involvement of community members in setting directions for the project, (e) support of the community, (f) initial and ongoing involvement of students in selecting and designing the project, (g) developmental appropriateness, (h) tangible results, and (i) clear connections to classroom learning (para. 11-14).

Another key component of service learning is reflection. Reflection is the major

difference between community service and service learning, because it encompasses the learning aspect of service (Koliba, 2000). Dewey (1938) considered reflection central to all learning activities, because of its role in helping the learner to act in a deliberate and intentional manner. He believed that experience becomes educative when reflection leads to new thought, growth, and action. Because service learning moves the student outside the classroom walls, it sometimes creates dissonance and confusion. Dewey considered this dilemma the very point at which reflection and thinking begin.

Reflection increases the transfer of knowledge and enables both teacher and students to participate in ongoing assessment and evaluation (Starnes, 1999). Reflecting on community needs also brings a political dimension to service-learning by allowing the students to address the politics of change (Shumer, 1999).

Reflection in service learning activities should be structured throughout the decision-making process. The students should be allowed to consider their role in the project and in the larger community. Reflection should also encourage thoughtful connections between the project and the student's strengths and weaknesses. It provides teachers opportunities to work with students to examine progress towards goals (Abernathy & Obenchain, 2001).

Reflection can be implemented in service learning in the form of reading, writing, doing, and telling. Student journals are common reflective vehicles in service learning projects because they are easy to assign, and they provide a way for students to keep a continuous record of their feelings and thoughts throughout the duration of the project. Directed readings and class presentations are also forms of reflection (Bringle & Hatcher,

1999).

The benefits of service learning for students include enhanced self-esteem and improved social skills. Critical thinking skills are developed as students analyze, hypothesize, and synthesize information to solve a problem. Furthermore, service-learning provides a whole experience in contrast to the fragmented single-subject orientation of learning in most schools, and it provides a sense of connectedness with real life (Ciaccio, 1999).

In a nationwide survey conducted by Conrad and Hedin (1991), of the 4,000 students involved in service-learning programs, 75% reported learning “more” and “much more” in these courses than in traditional classes. The researchers concluded that although more research needs to be conducted on the effectiveness of service learning programs, studies clearly show that significant positive affects are dependent upon the quality of the program implementation, the duration of the program, and the intensity of the program (number of hours per week).

Critics of service-learning and other “curriculum of place” activities in schools are often the proponents of basic academic skills attainment. Their concern is that out-of-school activities will cause students to pay less attention to academic achievement. The “standards movement” is often at odds with such practices as service learning because of its emphasis on high-stakes testing to measure student achievement. Further research is necessary to determine if a relationship exists between service learning and improved academic achievement (Koliba, 2000).

Well-conceptualized and well-organized service learning opportunities help students

to develop more favorable attitudes towards adults (Shumer, 1999). In addition, service learning activities help prepare young people to solve tomorrow's problems. Service learning prepares students to be members of a participatory democracy, where citizens take part in government, as opposed to a procedural democracy where citizens only maintain the right to vote (Westheimer & Kahne, 1999). According to General Colin Powell (2000), enlisting young people in service to their communities is one of the most urgent responsibilities we face as we enter a new century.

Action Research

One of the fundamental premises of environmental education as stated in the Tbilisi declaration is for citizens to have the "knowledge, skills, attitudes, motivation, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones" (Disinger & Monroe, 1994, p. 5). This goal can be met by integrating action research and a practical knowledge of community problem-solving into environmental education.

Citizen action was recognized even before the UNESCO statement was written when Stapp and Liston (1975) broadly defined environmental education as an educational process designed to increase individual awareness of, and concern about, the environment. They implied that by direct involvement with problem-solving and decision-making, individuals acquire a deeper understanding of the biophysical, social, economic, and political facets inherent in environmental problems.

The concept of citizen action to solve environmental problems was further refined

by Disinger and Roth (1992). They describe environmental literacy as a combination of cognitive and behavioral results in six major areas of learning, including sensitivity, knowledge, skills, attitudes and values, personal investment and responsibility, and active involvement. They contend that environmental literacy should be defined in terms of observable behaviors.

Disinger and Monroe (1994) state in the U. S. Environmental Protection Agency's *Environmental Education Workshop Resource Manual* that environmental literacy is the ability to perceive and interpret the health of the environment and take steps to maintain, restore, or improve the conditions of those systems. The concept of action research implies that the learner is empowered to take action through a process of continual evaluation and searching for solutions. Such a model was developed by William Stapp and has been applied in the Global Rivers Environmental Education Network, also known as GREEN (Stapp et al., 1994).

A theoretical and practical framework for environmental education, identified as Participatory Action Research (PAR), has been recommended by Mordock and Krasny (2001). They identify this framework as a solution to the problem of environmental education programs that emphasize student community research and environmental change but lack "a consistent, underlying theory." PAR is also defined as a process whereby outside researchers and community members collaborate to systematically gather information and apply the results. It was developed so that community members, rather than outside experts, could control the process of investigation and knowledge acquisition.

Several methods can be used in PAR including interviews, on-site observations,

monitoring of environmental conditions, mapping, oral histories, and collaborative planning sessions (Chambers, 1994). Project GREEN (Stapp et.al., 1994) uses a method similar to PAR with teachers and students participating simultaneously in both action and research, as opposed to doing research first, then taking action. According to Stapp et al., this strategy keeps students motivated throughout the project, as compared to the traditional method which separates research from action.

Before students can become involved in action research, they must understand how to identify problems, interrelationships, and alternatives (Trisler, 1993). One model for problem solving (Monroe & Kaplan, 1988) identifies 10 important elements:

1. Knowledge of the environment and of issues
2. Familiarity with solutions to problems
3. Knowledge of action strategies that help resolve issues
4. Skill in action taking
5. Locus of control and empowerment
6. Attitudes and values
7. Sense of responsibility and commitment
8. Group process skills
9. Communication skills
10. Problem solving.

Empowering students to determine the direction of their research is an essential part of PAR and other approaches to environmental education, but this component must be balanced with the provision of a knowledge base in science content and skills. The

challenge of environmental education is to ensure that global issues become meaningful to learners. This can be accomplished by helping students focus on individual contributions to environmental problems and then helping them develop and use problem-solving skills and decision-making strategies (Mordock & Krasny, 2001).

Current Studies Concerning Long-term Effects of Environmental Education on Student Attitudes and Behavior

Leeming et al. (1993) conducted a critical review of outcome research in environmental education from 1971-1991. Their review included two categories of environmental education, in-class and out-of-class interventions. They found that only 5 of the 34 studies measured changes or reported changes in environmentally relevant behaviors. Although most of the 17 class intervention studies reported positive effects, only 2 examined effects beyond the assessment. The assessment for these interventions was administered immediately following the interventions.

The length of time between the intervention and the follow-up for these two studies was 1 to 2 years. It is also important to note that these studies were conducted 20-25 years ago. Among the conclusions of this critical review for investigators in the field are the following: (a) rigorous designs with meaningful control groups should be incorporated in future studies, (b) controls for expectancy effects should be utilized, (c) reliable and valid dependent measures are needed, (d) follow-up data are lacking for most studies, and (e) appropriate unit analyses should be conducted.

I conducted a search for current studies from the past 5 years, concerning the long-term effects of environmental education. Several databases were used including ERIC,

Wilson Select Plus, Education Abstracts, Sociological Abstracts, PsycINFO, Digital Dissertations, General Science Abstracts, GeoBase, and GeoRefs, using descriptors such as environmental education, environmental project, outdoor education, behavior, attitude, learning, effect, and long-term effects. The results of this search produced no current studies of long-term effects of environmental education.

However I did find three studies, from 1999-2001, which focused on the short-term effects of environmental education. Two dealt with effects on students' knowledge and attitude, and one study examined the effects on students' behavior.

Sills (1999) assessed the effects of an environmental education field science program on students' attitudes of responsibility to the environment. Two groups of students were studied. One group participated in the program, and one group received no treatment. Attitudes were measured using the CHEAKS survey (Leeming, Dwyer, & Bracken, 1995). The data analysis suggested that there was no significant change in environmental attitudes between the groups, but did show significance in environmental knowledge growth.

Another study conducted by Yusof (1999) measured the effects of an environmental education program on the knowledge and attitudes of 13-17-year-old students in Malaysia, participating in an out-of-school program. The students were divided into experimental and control groups. The experimental group was exposed to a program conducted at an environmental education center, and the control group received no treatment. Data were collected using a modification of the CHEAKS survey. The results showed a significantly greater change in environmental knowledge and attitude with the

experimental group than with the control group.

Culen and Volk (2000) studied the effects of an extended case study on environmental behavior and associated variables in seventh- and eighth-grade students. This case study involved an issue investigation, evaluation, and action skills training model (ECS). The purpose of the research was to show that the ECS was an effective instructional method that could significantly increase several cognitive, conative, and affective variables. The study was an experimental design which involved 15 intact, heterogeneously grouped seventh- and eighth-grade classes. The treatment for the experimental group consisted of an ECS study about North American wetlands which lasted 10-14 weeks.

The control group received instruction in a traditional science program based upon a commonly used textbook. Results from the data showed statistically significant higher levels of knowledge and overt environmental behavior for the experimental group. The data were inconclusive on perceived skill in use of citizenship action skills.

Summary

The goals of environmental education, which were established 24 years ago to help protect and preserve this planet, are to be met through education. Since this task falls most often to teachers in classrooms, they should use those teaching strategies which have been documented as the most effective ways to teach environmental education. Environmental education, as a school subject, is often taught with a textbook in a classroom setting, but research suggests that this is not the most effective way to fulfill the objectives of

environmental education. Experiential education has been found to have positive effects on students' environmental knowledge, attitudes, and behavior.

Campbell, Moyers, and Flowers (1990) write, "The symbols don't render the experience, they suggest it. If you haven't had the experience, how can you know what it is?" (p. 61). Therefore, students should be given opportunities to make personal connections with the natural world as often as possible, out of doors where the environment can be seen, heard, smelled, and touched. If students are provided opportunities to develop a sense of love for a natural area, it may encourage subsequent environmentally responsible behavior (Newhouse, 1991).

Besides the benefits of outdoor/experiential education for teaching environmental education, research also suggests that teachers should allow their students to direct much of their learning (constructivism). Furthermore, incorporating cooperative learning, service learning, and action research into an environmental education curriculum may encourage students to develop and maintain positive attitudes and behavior toward the environment.

From Leeming et al.'s (1993) review of the literature and from my more recent review, it appears that very few studies have been conducted which measure long-term effects of environmental education on the attitudes and behaviors of students towards the environment. As a result of their study, Cullen and Volk (2000) stated that further research is needed on responsible environmental behavior—how it can be designed into the curriculum and taught effectively. They conclude that changes in attitude and knowledge are important, but it is changes in behavior that will ultimately determine the future of our environment.

CHAPTER THREE

METHODOLOGY

Design

This study is an attempt to establish a causal comparison relationship between student involvement in a school environmental project and their subsequent long-term environmental behaviors and attitudes. Accordingly, I have chosen to conduct a causal-comparative study because I believe this approach can adequately address my research hypotheses. I have also included a qualitative element, involving student interviews, to investigate some of the deeper implications of the Mission Environment (ME) project, and the development of a model for a middle-school environmental education project in the form of an Innovation Configuration.

A causal-comparative study is often called an *ex post facto study* because it can be used to observe a current condition, and in retrospect, infer the possible cause(s) of the condition. The independent variable, or “cause,” has already occurred, and cannot be manipulated (Gay, 1987). Causal-comparative research includes descriptive research in seeking to find answers through the analysis of variable relationships.

The key difference between causal-comparative and experimental research is that the groups being compared in causal-comparative research have already been formed, and

any treatment has already been employed. Therefore, the researcher must examine the records of the two groups to see if he can offer a logical explanation for the differences between the groups (Borg, Gall, & Gall, 1993).

If the samples are found to differ with respect to another variable, a causal relationship between the two variables is hypothesized. However, causal-comparative relationships cannot be firmly established except by experimental research. Thus causal-comparative research is a useful method of exploring possible causal relationships prior to conducting experiments to determine definitive causal connections. (p. 247)

Causal-comparative research is used widely in the behavioral sciences. In education it is often the only feasible approach to study causation, because it is often impractical or unethical to arrange occurrences or to manipulate variables, such as intelligence, personality, cultural deprivation, teacher competence, and others. But in spite of its wide use, there are several limitations including: independent variables which cannot be manipulated, subjects who cannot be randomly selected, and multiple rather than single causes (Best & Kahn, 1993).

Data Collection

Data for this research were collected using two techniques. A survey was administered, and semi-structured interviews were conducted.

Survey Research

Survey research usually employs questionnaires and interviews to determine the beliefs, attitudes, tendencies, and perceptions of research subjects (Borg et al., 1993). This type of research should not be confused with merely gathering and tabulating figures. It

must be guided by a clearly defined problem and specific objectives (Best & Kahn, 1993). Surveys are categorized as either sample surveys or census surveys. The sample survey is used when a researcher can infer information about a population based upon the responses of a sample taken from that population. A census survey is usually used for a small, easily accessible population in an attempt to acquire data from each and every member of a population.

For this study, a survey was administered to two groups of students to determine the possible effects of ME participation on the environmental attitudes and behavior of participating students compared to a group of non-participating students. The ME students who were surveyed participated in the project 4 years prior to the survey. The survey measured the environmental attitudes, knowledge, affect, and reported behavior of both groups of students. No actual behavior was measured. The purpose of the survey was to determine if the ME experience was a contributing factor to the possible disparity in levels of positive environmental attitudes and behaviors.

Interviews

The interview is a form of measurement that involves the collection of data through direct interaction between the researcher and the individuals being studied (Borg et al., 1993). Eisner (1991) compares interviewing to participation in a good conversation. An interview is a method to determine what is in, or on, someone else's mind. The interview enables a researcher to access the perspective of the person being interviewed.

We interview people to find out from them those things we cannot directly observe. . . . We cannot observe feelings, thoughts, and intentions. We

cannot observe behaviors that took place at some previous point in time. We cannot observe situations that preclude the presence of an observer. We cannot observe how people have organized the world and the meanings they attach to what goes on in the world. We have to ask people questions about those things. The purpose of interviewing, then, is to allow us to enter into the other person's perspective. (Patton, 1990, p. 196)

The form of an interview can range from informal and completely open-ended, to a very formal interview with predetermined questions asked in a standard manner (Best & Kahn, 1993). Semi-structured interviews were used in this study to collect additional data from participating students for the qualitative element of my study. They were also used to collect data for the development of an environmental education model, described in chapter 4.

Semi-structured Interviews

Merriam (1997) defines the semi-structured interview as being halfway between a structured and unstructured interview. The questions can be flexibly worded, or there can be a mixture of structured and less structured questions. The major part of the semi-structured interview is guided by questions or issues that are related to the purpose of the study. The format is flexible enough to allow the researcher to vary the interview according to the emerging thoughts of the interviewee.

Student interviews

I conducted interviews with three Mission Environment students for the descriptive case study segment of my research. These interviews were conducted to determine students' individual perspectives on participation in the project and on the learning

methods used in the project. The three students were selected because they had held offices in the ME corporation, and they were all easily accessible at the time of the interview process.

The case studies provide an interpretive element (Eisner, 1991), which Geertz (1973) refers to as “thick description.” Because the survey measures only the students’ environmental attitudes and reported behaviors, the interviews will provide additional data to help identify the personal implications of the project on the lives of the students.

Innovation Configuration interviews

For this study, semi-structured interviews were also used to collect data for creating a model of a middle-school environmental education project. This model has been developed as an Innovation Configuration (Hord et al., 1987).

Curriculum innovations need to be understood in operational terms so teachers can conceptualize the innovation’s use in their classrooms (Wright-Jones, 1999). To provide this practical conceptualization, Hord et al. (1987) designed the Innovation Configuration (IC) process from their Concerns-based Adoption Model (CBAM).

An IC is a process used to portray an educational program in operational terms. It represents the patterns of innovation described by teachers using the program in their classrooms. The operational features, termed components, are based on materials, teacher behaviors, and student activities. Variations of each component represent different methods teachers employ in the implementation of an innovation (Hord et al., 1987).

My co-teacher, a curriculum consultant, and I used the Innovation Configuration

interview questions to determine the components of the ME project. This information was used, along with data from the literature review and student interviews, to create an IC for a middle-school environmental education project.

The Survey Instrument

The survey instrument which I used, Measurement of Ecological Attitudes and Knowledge, was developed by Maloney and Ward in 1973 and revised in 1975 by Maloney, Ward, and Braucht. It was used to measure adult ecological attitudes and knowledge, including commitment (verbal and actual), behavior, and affect (Gray, Borden, & Weigel, 1985). Gray et al. conducted an extensive review of surveys for measuring ecological/environmental attitudes and knowledge, and concluded that the Maloney (1975) survey instrument was the best example of this type of scale.

Maloney and Ward (1973) recognized that the ecological crisis would not be solved by the use of technology but through the alteration of human behavior. They concluded that an assessment of the population was necessary before any changes could occur. Therefore they developed an ecological scale in an effort to determine the population's knowledge, attitude, affect, and behavior regarding the environment (Maloney et al., 1975). The original scale contained a 128-item ecological attitude-knowledge scale. The revised 1975 scale, used in this study, was refined and shortened to make it more practical and efficient.

In spite of the age of this instrument, it has been used as a basis for other studies (Benton, 1993; Borden, 1985; Borden & Schettino, 1979). This survey has also been

modified for research involving children. The modified survey was developed by Leeming et al., (1995), and named CHEAKS (Children's Environmental Attitude and Knowledge Scale). It was important to my study to obtain the most reliable data possible, therefore I chose to use the MEAK survey because it has been proven over time to be a reliable and valid instrument for environmental research.

For the purpose of this study, I used the original 45 questions from the revised (Maloney et al., 1975) Scale for the Measurement of Ecological Attitudes and Knowledge (MEAK). The survey questionnaire consists of five sections: An introductory Demographic Information section, Section 1 measures attitude, Section 2 measures behavior, Section 3 measures affect, and Section 4 measures knowledge.

Section 1 contains 10 questions with answers in a Likert scale response format (i.e., strongly agree, mildly agree, no opinion, mildly disagree, and strongly disagree.) The most positive environmental response to each item is credited 5 points, whereas the least positive environmental response receives a 1-point credit. No opinion response receives a 3-point credit.

The directions for Section 2 state the following: "Please answer these questions concerning your conservation practices since you began high school." This wording was selected to ensure that students would not count activities which were included in their ME participation. I wanted the survey to reflect students' conservation activities after ME participation. Section 2 contains 10 questions with answers, either true or false. The positive environmental response is credited 2 points and the negative environmental response is credited 1 point.

Section 3 contains 10 questions with answers in the same Likert scale response format as Section 1, and was scored in an identical manner as Section 1. Section 4 contains 15 multiple-choice questions with five possible answers labeled A-E. Each correct response was given 4 points.

The possible scores for Section 1 range from 10 to 50 points; for Section 2, 10-20 points; for Section 3, 10- 50 points; and for Section 4, 0-60 points; thus possible scores for the Total Scale range from 30-180 points. Five of the attitude items, five of the behavior items, and five of the affect items are negatively connoted and reverse scored to reduce the likelihood of student response set. (See Appendix D for complete survey instrument.)

Role of the Researcher

Researcher Bias

Peshkin (1988) states that subjectivity can be seen as virtuous, because it is the way researchers make a unique contribution based upon their own personalities joined to their data. He suggests that researchers should be aware of their own subjectivity in the process of collecting data, not after it has been completed, so that they can recognize both its disabling and enabling potential. I will briefly discuss, in this section, the disabling potential of research bias and the steps I have taken to reduce such bias.

A methodological problem that can be a concern in research is the likelihood of strong demand or experimenter expectancy effects in studies. Demand has been defined as the cues that determine a subject's perception of the researcher's goals and the subsequent tendency to behave that way. Experimenter expectancy refers to the ways that an

experimenter may influence his subjects to behave a certain way which may be consistent with his hypotheses (Leeming et al., 1993).

Because I am a participant researcher, I have addressed experimenter demand and expectancy in three ways:

1. The survey was administered by someone other than myself. The survey administrator picked up the surveys from my office and returned them to my office, so that I was not seen by the subjects at the time the survey was given.
2. My name did not appear anywhere on the letter of introduction or the survey instrument itself.
3. The survey was given to students 4 years after their involvement in the environmental project. Even with these precautions, however, several of the students had knowledge of my doctoral studies, and there is a chance that they may have surmised that the survey was part of my research.

Leeming et al. (1993) found that researcher demand and expectancy are greater when the measurement instrument is administered immediately after the intervention. Since 4 years have elapsed since the project was completed, it is hoped that researcher demand and expectancy are lessened.

According to Helberg (1996), other sources of researcher bias are conditions or circumstances which affect the external validity of statistical results. Therefore, two characteristics must be present for a researcher to make legitimate conclusions about a specific population: representative sampling and valid statistical assumptions. He states that if a random sampling is not possible, researchers should try to choose a sample in

which their group of subjects parallels the population with respect to the essential characteristics of that particular investigation. This is the reason that the samples for this study were students in the same class and from the same school. The characteristics which they had in common were age and educational background.

To reduce the likelihood of researcher bias for the qualitative element of this study, the following procedures were followed: (1) The interviews were audio-taped, (2) the interviews were transcribed by a professional transcriptionist, (3) themes were identified through the process of triangulation, in consultation with a qualitative researcher.

The Quantitative Researcher

My role as a quantitative researcher is to present evidence to explore the research hypotheses of my study by collecting and analyzing statistical data. I chose to conduct a largely quantitative study so that I would be able to control the parameters of the study as much as possible. According to Rudestam and Newton (1992) this method helps “restrict the focus of attention to a relatively narrow band of behavior. . . and get out of harm’s way as a detached and objective observer of the action” (p. 29). Since I am a participant researcher, this distance is necessary in order to reduce the likelihood of additional researcher bias.

The Qualitative Researcher

I wanted to add a qualitative dimension to my study because many research methodologists believe that many educational phenomena are best investigated through a combination of the two methods. It is believed that qualitative and quantitative methods

often appear to complement each other.

A quantitative study can be done to determine *how well* a particular instructional program works, whereas a concurrent qualitative study can be done to discover *why* it works or does not work and how it is perceived by educators, students, and the community (Borg et al., 1993, p. 202).

For the qualitative component of this study—the interviews—I questioned, recorded, and interpreted. In this form of research, the researcher is the lens through which the interactions, observations, or the phenomena are seen. Therefore, what the researcher sees will bear his/her own signature (Eisner, 1991). Thus, it is crucial that the researcher present his/her pre-existing biases concerning the phenomena of the study. It is also important for the researcher to establish his/her knowledge base. I will attempt to accomplish this by describing my background and training.

I am an educator, and as was mentioned in the introduction, I have a great interest in non-traditional forms of teaching based on constructivism, experiential education, and an integrated, hands-on approach to learning. During the past 20 years I have involved my students in many and varied experiences outside of the classroom, with an emphasis on the study of the natural world. From the years 1996-2000, I team-taught integrated language arts and environmental education in the framework of Mission Environment (ME), an environmental education project, which is the subject of this dissertation.

Population and Sample

The subjects are 71 students in the senior class at Collegedale Academy in Collegedale, Tennessee. Because this is an *ex post facto* study, I could not experimentally manipulate student participation. Participation in ME is the independent variable, and

positive environmental reported attitude and behavior are the dependent variables.

Twenty-eight of the surveyed students had participated in the ME project and 43 members of the class had not attended the same school as the ME students, and therefore did not participate in the ME project.

Data Collection

In May 2001, the survey was administered to members of the senior class of Collegedale Academy by the school guidance counselor. Permission was received by the researcher from the school principal to administer the survey. Since the research dealt with senior high-school students, the administration did not require a permission letter from parents. To ensure the least amount of procedural bias, the sample groups (students of the senior class) were not informed ahead of time that they would be participating in a survey. On the day the survey was administered, the class was asked to remain in the auditorium after their morning assembly program.

They were each given a survey instrument which included a cover letter explaining the purpose of the research. Students were not aware of the researcher's identity. No names were used on the surveys, and in addition, the survey instructions gave students the option of not completing the questionnaire.

Seventy-five members of the senior class were present, and completed the surveys at the time of its administration. Four surveys were disqualified because some of the demographic information was omitted. I hand scored and encoded the remaining 71 surveys myself, because I wanted to understand and participate in the entire data collection

process. I also analyzed the data using SPSS statistical software. The data spreadsheets and analysis results were subsequently spot-checked by another individual to confirm their accuracy. The following week, interviews were conducted with three students who were intensely involved with the ME project to discover, in greater detail, the effects of the project on them personally.

Hypotheses

Based on the research questions and review of the literature, the following research hypotheses were formulated for this study:

Hypothesis 1: There is a statistically significant difference between ME participants and non-participants in total attitude scores as measured by MEAK.

Sub-Hypotheses 1.1-1.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in Section 1, Attitudes, of the MEAK survey.

Hypothesis 2: There is a statistically significant difference between ME participants and non-participants in total behavior scores as measured by MEAK.

Sub-Hypotheses 2.1-2.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in Section 2, Behavior, of the MEAK survey.

Hypothesis 3: There is a statistically significant difference between ME participants and non-participants in total affect scores as measured by MEAK.

Sub-Hypotheses 3.1-3.10: There is a statistically significant difference between ME

participants and non-participants in the responses to each of the 10 items measured in Section 3, Affect, of the MEAK survey.

Hypothesis 4: There is a statistically significant difference between ME participants and non-participants in total knowledge scores as measured by MEAK.

Sub-Hypotheses 4.1-4.15: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 15 items measured in Section 4, Knowledge, of the MEAK survey.

Hypothesis 5: There is a statistically significant difference between ME participants and non-participants in total survey scores as measured by the self-administered survey for Measurement of Ecological Attitudes and Knowledge (MEAK).

Data Analysis Techniques

Inferential statistics, used in experimental studies, are also used in causal-comparative studies. Specifically, mean scores of each group are computed on the dependent variable, after which the two groups are compared to determine if the differences are statistically significant.

To test the research hypotheses, the survey data were analyzed with student's test for independent samples. Additionally, for sub-hypotheses 2.1-2.10 and 4.1-4.15, chi-square analysis was used.

The student's test for independent samples is used to evaluate the differences between the means of two independent groups. For each case there must be scores on two variables—the grouping variable and the test variable. There must be two mutually

exclusive groups, and the test variable must identify a quantitative dimension. Thus the t test determines whether the mean values of the test variables for the two groups are significantly different from each other.

There are three assumptions for the student's test for independent samples: (a) the test variable is normally distributed in each of the two populations, (b) the variances of the normally distributed test variable for the populations are equal, (c) the cases represent a random sample from the population, and the scores on the test variable are independent of each other.

As to the first assumption, because my sample size is greater than 15 cases per group, the results are expected to yield fairly accurate p -values. The p -value is the level of probability that the null hypothesis is true. For this study, the selected p -value is .05.

The problem of variances has been dealt with by choosing the control group from the same class and age group as the treatment group. In addition, Levene's Test for Equality of Variances was used to evaluate the equality of variances.

The first part of the third assumption is difficult to fulfill in a causal-comparative study because the groups already exist and are already different on the independent variable (ME participation), and therefore cannot be randomly selected. However, the two groups were as homogeneous as possible for this study (i.e., they were in the same age range, the majority of the control group had attended schools in the same parochial school system as the treatment group, and the majority of students in both groups had the same religious affiliation). The second part of the third assumption, that the scores on the test variable are independent of each other, has been met by using a survey that was confidential and self-

administered.

If the *t*-scores, for the student's test for independent samples used to evaluate the research hypotheses, are such that $<.05$, then the results of the data analysis are statistically significant, and the null hypotheses are rejected.

Because survey sections 2 and 4 were in the form of true and false, and multiple-choice, respectively, the chi-square test was used. Chi square is a non-parametric test of significance, and can be used to compare frequencies occurring in different categories.

CHAPTER FOUR

DATA ANALYSIS

Introduction

The purpose of this study is to examine the long-term effects on the reported environmental behavior and attitude of students who were involved in Mission Environment (ME), an eighth-grade environmental education project. By employing a survey, Measurement of Ecological Attitudes and Knowledge (MEAK), and conducting interviews, current reported environmental attitudes and behaviors of these participating students were studied.

The survey was administered to 75 members of a high-school senior class, 43 of whom were non-participants, 28 were ME participants, and 4 were disqualified because of missing demographic information. The mean scores of the ME students were compared to the mean scores of the non-participating students, to determine if there were statistically significant differences in their environmental attitudes and behaviors. Additionally, the mean scores of the ME students were compared to the mean scores of the non-participating students to determine if there were statistically significant differences in their environmental knowledge and environmental affective responses as reported on the MEAK survey.

Three ME students were also interviewed to obtain more in-depth perceptions about ME. And finally, a model for a middle-school environmental education project was designed using data collected during the interviews and from the literature review.

This chapter will present the results of the study in three sections.

1. Survey Results: statistical findings using descriptive and inferential statistics
2. Interview Results: student interviews using content analysis
3. Innovation Configuration for a Middle School Environmental Education Project: using data collected during student and teacher interviews, and from the literature review.

Section 1: Survey Results

Summary of Scores for Sections 1-4 of MEAK

The quantitative database consisted of four MEAK section scores—attitude, behavior, affect, and knowledge, and an overall score, for the two groups of students. The mean score for Section 1 of MEAK, which measured attitude, was 29.3, and the scores ranged from a minimum of 12 to a maximum of 44. The mean score for Section 2 of MEAK, which measured behavior, was 12.11, and the scores ranged from a minimum of 10 to a maximum score of 19. The mean score for Section 3, which measured affect, or emotional response, was 30.73, and the scores ranged from a minimum of 10 to a maximum of 46. The mean score of the Section 4 of MEAK, which measured knowledge, was 18.44, and the scores ranged from a minimum of 0 to a maximum of 40.

Table 1 provides a summary of the MEAK survey scores for Sections 1-4.

Table 1

Summary of MEAK Scores for Sections 1-4

	Possible Range	Actual Range	Mean	SD
Section 1 Attitude	10-50	12.00-44.00	29.30	8.82
Section 2 Behavior	10-20	10.00-19.00	12.11	2.08
Section 3 Affect	10-50	10.00-46.00	30.73	8.75
Section 4 Knowledge	0-60	.00-40.00	18.44	9.18
Total Survey Score	30-180	41.00-137.00	90.51	20.65

Hypotheses of the Study

The following five research hypotheses and four sub-hypotheses guided this study:

Hypothesis 1: There is a statistically significant difference between ME participants and non-participants in total attitude scores as measured by MEAK.

Sub-Hypotheses 1.1-1.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in MEAK Section 1, which measured attitudes.

Hypothesis 2: There is a statistically significant difference between ME participants and non-participants in total behavior scores as measured by MEAK.

Sub-Hypotheses 2.1-2.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in MEAK Section 2, which measured behavior.

Hypothesis 3: There is a statistically significant difference between ME participants and non-participants in total affect scores as measured by MEAK.

Sub-Hypotheses 3.1-3.10: There is a statistically significant difference between ME

participants and non-participants in the responses to each of the 10 items measured in MEAK Section 3, which measured affect.

Hypothesis 4: There is a statistically significant difference between ME participants and non-participants in total knowledge scores as measured by MEAK.

Sub-Hypotheses 4.1-4.15: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 15 items measured in MEAK Section 4, which measured knowledge.

Hypothesis 5: There is a statistically significant difference between ME participants and non-participants in total survey scores as measured by the self-administered survey for Measurement of Ecological Attitudes and Knowledge (MEAK).

Hypothesis 1

To test research hypothesis #1, the following null hypothesis was tested: There is no statistically significant difference between ME participants and non-participants in attitude as measured by the self-administered MEAK survey.

A student's test for independent samples was performed on the mean scores for survey section 1, which measures attitude. The null hypothesis is rejected, $t(69)=-2.107$, $p<.05$. The ME students ($M=31.96$, $SD=7.75$) on the average scored higher than the non-participating students ($M=27.56$, $SD=9.12$).

Table 2 presents descriptive statistics for research hypothesis #1.

Table 2

The Mean Attitude Scores, Standard Deviations, and Standard Error of the Means for the Survey Participants

Participant Type	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Participant	28	31.96	7.75	1.47
Non Participant	43	27.56	9.12	1.39

Sub-hypotheses 1.1-1.10

To test research sub-hypotheses 1.1-1.10, the following null hypothesis was tested. There is no statistically significant difference between ME participants and non-participants in their responses to each of the 10 items in MEAK Section 1, which measures attitude.

A student's independent samples *t* test was used to test each of the hypotheses 1.1-1.10. The null hypothesis is rejected for responses 1.1, 1.5, 1.6, and 1.10 which are statistically significant $<.05$. Table 3 summarizes the results of testing the 10 responses for MEAK, Section 1.

Interpretation of survey section 1 results

The participants' mean response for statement 1.1 is 2.50 and the non-participants' mean response is 3.16. This difference is statistically significant at $p=.05$ and indicates that the participating students reported a more positive attitude towards the environment than the non-participating students.

Statement 1.5 is negatively connoted, and the participants' mean response of 4.00,

Table 3

The Mean, Standard Deviation, t-value, and Significance for Survey Section 1 Responses

Question	Participant Type	Mean	SD	t-value	p
SECTION 1					
1. I'd be willing to ride a bicycle or take a bus to work in order to reduce air pollution.	NP	3.16	1.40	1.98	.05*
	P	2.50	1.34		
2. I would probably never join a group or club which is concerned solely with ecological issues.	NP	2.95	1.51	.069	.95
	P	2.92	1.44		
3. I would be willing to use a rapid transit system to help reduce air pollution.	NP	2.65	1.29	1.16	.25
	P	2.30	1.17		
4. I'm not willing to give up driving on a weekend due to smog alert.	NP	2.93	1.52	-.291	.77
	P	3.04	1.45		
5. I'm really not willing to go out of my way to do much about ecology since that's the government's job.	NP	3.19	1.31	-2.60	.01**
	P	4.00	1.25		
6. I would donate a day's pay to a foundation to help improve the environment.	NP	3.63	1.46	3.51	.00***
	P	2.42	1.32		
7. I would be willing to stop buying products from companies guilty of polluting the environment even though it might be inconvenient.	NP	3.21	1.50	1.81	.08
	P	2.61	1.13		
8. I'd be willing to write my congressman weekly concerning ecological problems.	NP	4.16	1.13	.467	.64
	P	4.04	1.10		
9. I probably wouldn't go house to house to distribute literature on the environment.	NP	2.47	1.67	.093	.93
	P	2.43	1.55		
10. I would not be willing to pay a pollution tax even if it would considerably decrease the smog problem.	NP	2.98	1.63	-1.99	.05*
	P	3.71	1.36		

Note. NP=Non participant; P=Participant.

*Equal to or less than .05. **Equal to or less than .01. ***Equal to or less than .001.

mildly disagree, represents a more positive reported attitude toward the environment than the non-participants' mean response of 3.19, no opinion.

The participants' mean response for statement 1.6 is 2.42 and the non-participants' mean response is 3.63. This difference is statistically significant at $p=.00$, and indicates that the participating students reported more positive attitudes towards the environment than the non-participating students.

Statement 1.10 is negatively connoted, and the participating students' mean response of 3.71, is evidence of more positive reported attitude than the non-participating student's mean response of 2.98. The difference is statistically significant at $p=.05$.

All four responses for survey Section 1, which showed statistically significant differences between the participating and non-participating students, indicated more positive reported environmental attitudes among the participating students than the non-participating students.

Hypothesis 2

To test research hypothesis #2, the following null hypothesis was tested: There is no statistically significant difference between ME students and non-participating students in behavior as measured by MEAK. The student's test for independent samples was performed on the mean scores of the MEAK survey, Section 2, which measured behavior. The null hypothesis is rejected, $t(69)=4.45$, $p<.00$. ME students ($M=13.22$, $SD=2.51$) on the average scored higher than the non-participating students ($M=11.32$, $SD=1.25$). Table 4 presents descriptive statistics for hypothesis #2.

Table 4

The Mean Behavior Scores, Standard Deviations, and Standard Error of the Means for the Survey Participants

Participant Type	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Participant	28	13.32	2.51	.47
Non Participant	43	11.33	1.25	.20

Sub-hypotheses 2.1-2.10

To test research sub-hypotheses 2.1-2.10, the following null hypothesis was tested:

There is no statistically significant difference between ME participants and non-participants in their responses to each of the 10 items in MEAK Section 2, which measures behavior.

Chi square was used to test hypotheses 2.1-2.10. The null hypothesis is rejected for responses 2.1, 2.2, 2.3, 2.5, 2.6, 2.7, and 2.10 which are statistically significant $<.05$.

Table 5 summarizes the results of testing the 10 responses for MEAK, Section 2.

To further describe the test results for survey Section 2, Table 6 lists the percentages of negative and positive responses for participants and non-participants for each statistically significant response.

Interpretation of survey section 2 results

Data analysis of survey section 2 reveals that for statements 2. 1, 2.2, 2.3, 2.5, 2.6, 2.7, and 2.10 there is a statistically significant difference between participant and non-participant responses. For each of these statements, the ME students had a higher percentage of positive responses than the non-participating students.

For statements 2.4, 2.8, and 2.9, there was not a statistically significant difference

Table 5

The Chi Square, Degrees of Freedom, and Significance for Survey Section 2 Responses

Statement	Chi Square	df	p
1. I guess I've never actually bought a product because it had a lower polluting effect.	5.98	1	.02*
2. I keep track of my congressman and senator's voting records on environmental issues.	5.29	1	.02*
3. I have never written a congressman concerning the pollution problems.	3.71	1	.05*
4. I have contacted a community agency to find out what I can do about pollution.	3.16	1	.08
5. I don't make a special effort to buy products in recyclable containers.	4.48	1	.03*
6. I have attended a meeting of an organization specifically concerned with bettering the environment.	5.92	1	.02*
7. I have switched products for ecological reasons.	9.79	1	.00***
8. I have never joined a cleanup drive.	2.49	1	.11
9. I have never attended a meeting related to ecology.	1.85	1	.17
10. I subscribe to ecological publications.	4.77	1	.03*

*Equal to or less than .05. **Equal to or less than .01. ***Equal to or less than .001.

Table 6

A Comparison of Response Patterns for Participant and Non-Participant Statistically Significant Responses for Survey Section 2

Item Number	Part.	% Positive	% Negative
1	P	39.3	60.7
	NP	14.0	86.0
2	P	17.9	82.1
	NP	2.3	97.7
3	P	14.3	85.7
	NP	2.3	97.7
5	P	28.6	71.4
	NP	9.3	90.7
6	P	32.1	67.9
	NP	9.3	90.7
7	P	32.1	67.9
	NP	4.7	95.3
10	P	21.4	78.6
	NP	4.7	95.3

Note. P=Participant; NP=Non participant.

between the responses of ME students and non-participating students. The highest percentage of statistically significant positive responses among the ME students was to statement 2.1, and the lowest percentage of statistically significant positive responses among ME students was to statement 2.3.

Hypothesis 3

To test research hypothesis #3, the following null hypothesis was tested: There is no statistically significant difference between ME students and non-participating students in affect as measured by MEAK. The student's test for independent samples was performed

on the mean scores of MEAK Section 3, which measured affect. The null hypothesis is rejected, $t(69)=1.969$, $p<.05$. The ME students on the average scored higher ($M=33.21$, $SD=9.21$) than the non-participating students ($M=29.12$, $SD=8.66$). Table 7 summarizes the descriptive statistics for hypothesis #3.

Table 7

The Mean Affect Scores, Standard Deviations, and Standard Error of the Means for the Survey Participants

Participant Type	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Participant	28	33.21	9.21	1.6
Non Participant	43	29.12	8.66	1.3

Sub-hypotheses 3.1-3.10

To test research sub-hypotheses 3.1-3.10, the following null hypothesis was tested. There is no statistically significant difference between ME participants and non-participants in their responses to each of the 10 items in MEAK Section 3, which measures affect.

The student's independent samples t test was used to test hypothesis 3.1-3.10. The null hypothesis is rejected for responses 3.1 and 3.3 which are statistically significant at $p<.05$. Table 8 summarizes the results of testing the 10 responses for MEAK, Section 3.

Interpretation of survey section 3 results

The participating students' mean response for statement 3.1 is 4.04 which indicates

Table 8

The Mean, Standard Deviation, t-value, and Significance for Survey Section 3 Responses

Question	Participant Type	Mean	SD	t-value	p
1. I feel people worry too much about pesticides on food products.	NP	3.37	1.29	-2.19	.03*
	P	4.04	1.17		
2. It frightens me to think that much of the food I eat is contaminated with pesticides.	NP	2.86	1.41	1.57	.12
	P	2.32	1.42		
3. It genuinely infuriates me to think that the government doesn't do more to help control pollution of the environment.	NP	3.00	1.57	2.27	.03*
	P	2.21	1.17		
4. I feel fairly indifferent to the statement: "The world will be dead in 40 years if we don't remake the environment.	NP	2.70	1.26	-.871	.39
	P	3.00	1.66		
5. I become incensed when I think about the harm being done to plant and animal life by pollution.	NP	2.67	1.23	1.31	.20
	P	2.29	1.21		
6. I'm usually not bothered by so-called "noise pollution."	NP	2.76	1.45	.342	.73
	P	2.64	1.39		
7. I get depressed on smoggy days.	NP	3.40	1.51	.910	.37
	P	3.07	1.39		
8. When I think of the ways industries are polluting, I get frustrated and angry.	NP	3.05	1.46	1.30	.20
	P	2.59	1.37		
9. The whole pollution issue has never upset me too much since I feel it's somewhat overrated.	NP	3.12	1.42	-1.24	.22
	P	3.54	1.35		
10. I rarely even worry about the effects of smog on myself and family.	NP	2.40	1.38	-.416	.68
	P	2.54	1.40		

Note. NP=Non participant; P=Participant.

*Equal to or less than .05. **Equal to or less than .01. ***Equal to or less than .001.

mildly disagree, and the non-participating students' mean response is 3.37, no opinion towards mildly disagree. The difference between the mean responses is statistically significant at $p=.03$. The participating students' mean response indicates more positive reported affective response than the non-participating students' affective mean response.

The participating students' mean response for statement 3.3 is 2.21—mildly agree, as compared to the non-participating students' mean response of 3.00—no opinion. The difference between the mean responses is statistically significant at $p=.03$. The participating students' mean response indicates more positive reported affective response than the non-participating students' reported affective response.

Hypothesis 4

To test research hypothesis #4, the following null hypothesis was tested: There is no statistically significant difference between ME students and non-participating students in total knowledge scores as measured by MEAK.

Chi-square was performed on the mean scores of MEAK Section 4, which measured knowledge. The null hypothesis is accepted, $t(69)=1.599$, $p>.05$. The ME students on the average scored higher, $M=20.57$, $SD=9.21$, than the non-participating students, $M=17.05$, $SD=8.99$, but the difference was not statistically significant. Table 9 presents descriptive statistics for hypothesis #4.

Sub-hypotheses 4.1-4.15

To test research sub-hypotheses 4.1-4.15, the following null hypothesis was tested. There is no statistically significant difference between ME participants and non-participants

Table 9

The Mean Knowledge Scores, Standard Deviations, and Standard Error of the Means for the Survey Participants

Participant Type	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Participant	28	20.57	9.22	1.7
Non Participant	43	17.05	8.99	1.4

in their responses to each of the 15 items in MEAK Section 4, which measures knowledge.

Chi-square was used to test sub-hypotheses 4.1-4.15. The null hypothesis is accepted for all 15 responses for MEAK, Section 4. Table 10 summarizes the results of testing the 15 responses for MEAK, Section 4.

Interpretation of survey section 4 results

Chi-square analysis of Survey Section 4—Knowledge, indicates that the responses in this section seem to be evenly distributed across both participant and non-participant students.

Hypothesis 5

To test research hypothesis #5, the following null hypothesis was tested: There is no statistically significant difference between ME participants and non-participants in total MEAK scores as measured by the self-administered MEAK survey.

The student's test for independent samples was performed on the mean total scores of the MEAK survey. The null hypothesis was rejected, $t(69)=-2.904$, $p<.05$. The participating students ($M=98.89$, $SD=18.93$) on the average have higher total scores than

Table 10

Chi Square, Degrees of Freedom, and Significance for Survey Section 4

Question	Chi Square	df	p
1. Soil pollution is generally due to: A) sparse rain, B) improper farming methods, C) poisonous metals, D) over-fertilization, E) poor crop rotation.	2.45	4	.65
2. Most smog in our big cities comes from: A) automobiles, B) supersonic jets, C) industrial plants, D) large trucks, E) refuse disposal.	2.75	2	.25
3. High concentrates of chlorinated hydrocarbon residues: A) cause sheep to die, B) are found in large amounts in our atmosphere, C) accumulate in flesh-eating birds and upset breeding behavior, D) are no longer legal in pesticides, E) are readily biodegradable.	4.56	4	.34
4. Mercury has been found at unacceptable levels in A) fruit, B) vegetables, C) seafood, D) beef, E) soft drinks.	1.47	4	.83
5. Which of the following does not appreciably reduce the pollution of automobiles? A) properly tuned engine, B) high octane gas, C) low lead gas, D) smog control devices, E) propane engines.	2.20	4	.70
6. The most common pollutants of water are: A) arsenic, silver nitrates, B) hydrocarbons, C) carbon monoxide, D) sulphur, calcium, E) nitrates, phosphates.	5.20	4	.27
7. Ecology is best described as the study of A) the relationship between man and the environment, B) the relationship between organisms and the environment, C) pollution and its control, D) the environment, E) recycling of products.	1.72	4	.79
8. Which of the following materials usually takes longest to decompose? A) tin, B) iron, C) copper, D) aluminum, E) steel.	4.00	4	.41
9. Birds and fish are being poisoned by: A) iron, B) mercury, C) silver, D) lead, E) magnesium.	3.67	4	.45
10. All but one of the following decompose in ocean water: A) sewage, B) garbage, C) tin cans, D) plastic bags, E) chemical fertilizer.	4.12	4	.39

Table 10—Continued

Question	Chi Square	df	p
11. What is the harmful effect of phosphates on marine life? A) causes cancer, B) renders fish sterile, C) induces nervous reactions in fish, D) makes H ₂ O cloudy, E) feeds algae which suffocates fish.	2.50	4	.64
12. Which of the following well-known groups is primarily interested in conservation issues? A) Boy Scouts of America, B) The Sierra Club, C) Kiwanis, D) 4-H Club, E) The Ecology Association.	1.44	4	.84
13. Practically all of the lead in our atmosphere is caused by: A) cars, B) industrial plants, C) airplanes, D) burning refuse, E) cigarettes.	1.64	4	.80
14. DDT takes how long to deteriorate into harmless chemicals? A) it never does, B) 10-20 months depending on the weather, C) about 200 years, D) about 400 years, E) anywhere from several days to several years.	.49	4	.98
15. Ecology assumes that man is: an _____ part of nature. A) differential, B) integral, C) inconsequential, D) superior, E) original	3.10	4	.54

the non-participating students ($M=85.05$, $SD=20.07$). Table 11 presents descriptive statistics for Hypothesis 5.

Table 11

The Mean Total Scores, Standard Deviations, and Standard Error of the Means for the Survey Participants

Participant Type	N	M	SD	SE
Participants	28	98.89	18.93	3.58
Non Participants	43	85.05	20.07	3.06

Section 2: Interview Results

Interviews

Three students were interviewed to obtain more in-depth perceptions about how ME affected their environmental attitudes and how it affected their attitudes about school, learning, and life in general.

The following six questions, which were derived from my research questions, guided the interviews. But because the interviews were semi-structured, at times the responses digressed somewhat from the intended format; consequently, not all of the questions were asked of all interviewees.

1. What goals did you think my co-teacher and I had for this project?
2. What is your understanding of the methods used to teach this project?
3. What did you like about the way it was taught?
4. What didn't you like about the way it was taught?
5. What was your attitude about nature/conservation before this project? Did it change?
6. What did you learn from the ME experience that affects your life now and probably will affect your life in the future (family, career choice, love of learning/school, appreciation for the natural world, community service/civic responsibility).

An inductive analysis was used to interpret the results of these interviews. In the process, the responses were categorized into three major themes related to the interview questions: (a) student perceptions of the project goals, (b) student perceptions of the methods used to teach the project, and (c) the long-term effects of the project, including

attitudes and behavior toward the environment, career choices, and civic responsibility.

Project Goals

With the ME co-developer, I wrote a proposal early in the spring of 1996 for our environmental project, incorporating the following goals:

1. To provide opportunities for students to participate in experiential, project-based learning
2. To establish a framework for learning which would integrate English and science curricula
3. To provide opportunities for students to work cooperatively in groups
4. To provide opportunities for students to care for the environment
5. To provide opportunities for students to make a positive contribution to their community.

The students who were interviewed seemed to have an understanding of at least some of these goals. All three recognized that the purpose of the project was to change the way students traditionally learn in school from a textbook-based to an experience-based, out-of-the-classroom approach.

I think the main goal of Mission Environment was to get the greenway started here in Collegedale, and other than that, of course, you were trying to show practical applications to some of the learning we have had. You know, how it actually turns into real life. (Respondent #1)

You wanted a more effective way, more creative way of teaching students things that would impact them for the rest of their lives. I think it was your goal to do that to make a positive impact on them to want to care for the environment. (Respondent #2)

I thought that you wanted to have a more experience-based curriculum for

the eighth-grade, where students, instead of simply reading books and memorizing facts, that things like designing web pages, getting involved in corporate structure, set real-world goals, and accomplish them.
(Respondent #3)

Teaching Methods

I have incorporated experiential learning into my teaching, believing that real experiences, rather than just reading about them, will be more effective for cognitive retention and for developing a life-long love of learning. This was the teaching strategy which formed the basis of the ME project, and from the interview data, it appears that these students, at least, understood our method of teaching.

For English class we were writing letters and trying to get the project going, rather than circling the verb in the sentence and stuff like that. It's kind of the same thing, we were actually out there doing water quality tests or whatever, instead of reading in the book. We were in the laboratory, which we did somewhat, but a lot of it was done at the creek itself. . . . It wasn't just theory, it was actually applied school. And I guess I really liked that, and I have liked classes that do that ever since. Laboratory classes where we are actually doing it and not just learning about it. (Respondent #1)

You more or less gave hands-on experience, real-life experience rather than just using a textbook. For example, in English, I remember you would have us write letters, like I wrote several letters and that would count as my English assignment. Well, that's writing, but it is not an assignment—it is an actual thing.

. . . It definitely helped my love of learning. I was put into a situation where I was learning on my own. I mean, you guys were teaching us, but it was like I said, it was that freedom that you were giving us that allowed us to go as far as we wanted to, and I benefitted from it.
(Respondent #2)

I think there was a lot of independence for the students for personal study. There was less supervision over each individual's work, specialized projects like the web design team that met, I think once or twice a week. But otherwise I was given the instructional material and was to be self-taught. The teams who did research with flowers or water ecology did so with tests provided by the teachers, but not with normal didactic method. It was go

out there and explore and bring your questions back. (Respondent #3)

I asked the students to express both the positive and negative aspects of the teaching methods used for our project. They all seemed to appreciate the student-directed rather than teacher-directed approach used in this project and they indicated that they experienced a sense of accomplishment as a result of their work.

We could kind of choose our area of interest and we could go into that more than into some other area that didn't interest us quite as much. Like I was interested in web and video stuff, so I did some web programming and some video stuff that I learned. I still use the knowledge about web programming that I gained there. I'm getting a job this summer, in fact, in that, and I didn't know anything about it until I studied it in the eighth grade. (Respondent #1)

I liked the individual freedom it gave to allow me to achieve a lot more. It really gave me a chance to make a real impact. Just go down to the Four Corners now and you'll see the impact, and it's real (the greenway). And I just walked the second phase of it last weekend for the first time. It was something for the first time thinking there was a group of us who really had made this happen—that I think is the biggest benefit. (Respondent #2)

I enjoyed being able to choose a discipline that appealed to me and pursue that fairly independently without too much interference. And I enjoyed being partners with people who I liked working with who had a similar passion for the subject matter. (Respondent #3)

Because Mission Environment was an innovative curriculum, my co-teacher and I were aware of very few teachers who were engaged in similar projects. Therefore many aspects of our program were developed in the process of teaching, through trial and error. In hindsight, we both recognize areas that could have been improved had we continued the project another year.

Due to the nature of our work with community resources, situations would often present themselves that did not allow us much time for preparation. Also, class size varied

during the 4 years we had the project, from a low of 42 students to a high of 56 students, with the changing mix of learning styles and personality types. We had to learn to adapt our activities to the times, circumstances, and students. And at times, these adaptations were not adequate to keep the organization finely tuned.

I think there could have been some more structure, actually. There was a lack of structure for those who were unable to function in that type of environment. . . .I think in retrospect if you guys were to do it again, you would want to approach it maybe a little more balanced on the structure versus non-structure. (Respondent #2)

Without the forced discipline there were a number of people who didn't have much direction. (Respondent #3)

Another area that seemed to be a concern to some students was that the Mission Environment project did not include enough practice in certain skills, particularly in the area of English grammar. The high school that most of the eighth-graders entered placed a great deal of emphasis on grammar, and the emphasis for my English students was on writing skills. So when these students took entrance exams for English class placement, they scored low in grammar, and unfortunately many were placed in lower level classes as a result.

To be honest with you, when we got into high school, I realized that some of my grammar skills were not up to where they should have been. Mainly my English skills weren't quite what they should have been basically. (Respondent #1)

Assessment for project-based, cooperative activities is an area that needed to be further developed. Both my co-teacher and I developed some grading rubrics and endeavored to move away from traditional testing to performance assessment. But these were unfamiliar procedures to most of the students, and they often didn't understand how

grades were determined.

Without the forced discipline, there were a number of people who didn't have much direction. And it did make evaluation very difficult, because it was hard to come up with what were the standards that were to be expected. . . .I thought that became a touchy issue at the end of the semester. . . .I felt there were some groups who obviously did more work in accomplishing a lot more than others simply because they were more self-motivated. I felt that there were some instances where we were penalized for failing to understand—that it was more than should be expected of eighth-graders. (Respondent #3)

Long-Term Effects of the Project

Positive Environmental Attitudes and Behavior

Obviously, the most important goal of the Mission Environment project was that students would acquire positive attitudes towards the environment which would lead to pro-active environmental behavior. We wanted our students to develop a genuine love for the natural world, to take ownership of it, and to actively protect it for the rest of their lives. The responses of the three interviewees illustrate their achievement of this goal. In answer to the question, "What was your attitude about nature conservation before you got involved in this project and did it change?" the students had this to say:

Well, I really hadn't thought much about it. I mean, I have always been taught not to litter and all that kind of stuff, but hadn't really thought about conservation and preservation and all that kind of stuff like I did afterwards. . . . I started to keep in mind that what we do affects everything down the line somewhere. Every choice that we make has a payoff somewhere else. (Respondent #1)

I would say that before junior high school most kids don't think about conservation per se until they are awakened. I mean, I like the out of doors, love to stay outdoors. I think everybody would say that they don't like to see piles of litter—where there's a "No Dumping" sign, there's 50 gallons of whatever, you know. I didn't like that before, didn't like seeing trash. But I don't think I was aware of the environmental issues. So I definitely think

you could point out a change that took place when I became aware and ever since then I have been aware. Ever since Mission Environment, I have been very aware and I consciously, whenever I see a piece of trash on the side of the road, and this is true, every time I see it one of two things happen. Either I have a guilt trip, or I pick it up! It's not that I can just walk by and feel nothing. And I have to say even now I'm not the best environmental person, but I know it in my mind. But it opened my eyes to that and I think it [Mission Environment] did for a lot of people. (Respondent #2)

I had a passing interest in conservation. Obviously, I wasn't looking forward to a world with no ozone layer and no rain forests, but it was something that I was passive about, not serious about. Afterwards, when I realized that there were things that could be done to make a difference, I became more involved and carried some of that with me in my high school career. (Respondent #3)

Community Service/Civic Responsibility

I believe that the service learning emphasis contributed, in a large degree, to the positive results of the ME project. In order to provide this opportunity for our students to be involved in service to their community, we had to collaborate with local civic leaders.

The Collegedale city manager was anxious to find a group who could get excited about building a greenway along Wolftever Creek, and we were looking for something tangible, an experience for our students in the context of environmental education. It was out of this unique partnership that our project was born. It was our hope that the students' involvement with their community would continue long after the project was completed.

According to the responses in the interviews, this has occurred.

I have been going to that Wolftever Creek cleanup almost every year if I can, just because that is something I am kind of involved in, and something I like to keep working on even though I am not involved in the project anymore. In fact, it has made me more aware of the environment and as I've gotten older I think I have seen how you can get things done through letter-writing and through petitioning and all this kind of stuff. It kind of showed me the process, if that answers your question. (Respondent #1)

It has definitely made me more aware of civic responsibility—we do have a responsibility to care for what is around us. And you know what, I remember now thinking back to some of the classes you even taught us, or showed me anyway, the pull of the economy and the need for people to live and be successful and the need to protect the environment. And those often conflict, whether it comes to government funding or who should build what, where. Those often conflict and it made me aware of that struggle. . . . I think seeing the City Commissioners has helped me to develop a relationship with them now. So some commissioners have now been voted out, but nevertheless, the new mayor came up to me after he was elected and said, “Well, we need to get together and talk about the greenway.” (Respondent #2)

I think that community service was something that I took away from it, as I am doing far more community service than I expected. And I find that community service could be enjoyable. I loved the Washington trip, I mean that was the highlight of the experience. It was very shocking to see the greenway actually built. Seeing it go up made you feel like you were part of something very important and something real, whereas most people in the eighth-grade think of themselves as marginalized, they are not really active participants in the society. They don’t really have a voice for change, and we proved that we did have a voice. It really showed you how you have a progression of effort, and we began simply by discussing a plan of changing the environment, then came the actual legwork of going to Wolfcreek Creek and surveying the area. Then came the creative time when we had to learn the skills for web design and satellites and whatever else needed doing. And then after all of that drudge work, you find yourself in Washington, D. C. at a wetlands conference giving a presentation. And you realize, wow, I didn’t get here just because I had connections or just because I could afford a plane ticket. I got here because I put in effort all along the way in incremental steps. And that was pretty surprising in retrospect that that was accomplished. (Respondent #3)

Effects of the Project, Present and Future

As is the goal of all learning, we hoped that the ME project would have positive effects on our students during its implementation, as well as in the future. The interviewees responded as follows to the question, “What did you learn from your ME experience that affects your life now and probably will affect your life in the future?”

Well, now like I said before, I had my job this summer just because of the skill that I picked up in Mission Environment that I probably wouldn't ever have gotten into other than that. In the future, it's hard to say because there is so much that happens between Mission Environment and the future.

(Respondent #1)

Well, I could go a lot on that. I think it affected my conservation so I want to start there, in the sense that I will always have it in my mind, even whatever I do in the future I think I'm going to remember the importance of the environment. I am going to remember the fact that I was involved in an organization that was able to affect the environment. I feel the Mission Environment was to really inspire people here in the local community through the greenway to care about Wolftever Creek—I think that mission was accomplished. And I think that will always have an impact on me whenever I think of environmental issues, today and in the future.

So in other areas—writing. Writing letters—that affected me, and communication skills. I had to do a decent amount of speaking and that certainly affected me and who knows in what other ways. I ran for eighth-grade president and lost, but I won Mission Environment. And so I came out of my shell during eighth-grade and I went to academy in the Student Association and was president there for two years—that affected me.

Even aside from that, the connections I made with people, even Zach Wamp, our congressman, I still have today and we have communicated back and forth ever since then, and he still remembers that. He said, "Yes, I do remember you guys when you came in and saw me." There are a lot of things that helped me in my growth that I'm sure will be with me for my life.

(Respondent #2)

Mostly organization and how to get the impetus going for a major project. You have to really have all your ducks in a row, but have clear and specific goals and delegate responsibilities in a clear and straightforward fashion. And then put forth or at least pretend to have a plan if you don't, because if those in leadership are still working through issues, then the subordinates are likely to goof off. Also, you have just got to be wary of everyone who offers their services, because some people are doing it for reasons which you may not suspect. (Respondent #3)

Most eighth-grade students are beginning to seriously consider career choices, and for this reason, my co-teacher and I hoped students would develop interests in areas that could eventually become careers. Two interviewees explained how their experience with

ME may have impacted their career choices.

It just sort of solidified that I really enjoy doing communication/public relations type work, which is kind of the stuff I was doing for Mission Environment and how I really enjoyed that. And how if I can make that a career I would actually love what I'm doing. It kind of gave me, it was almost like I was working for awhile and I could kind of see if I liked what I was doing. (Respondent #1)

I think my interests more or less remained the same. I don't see myself going into environmental law or anything of that nature. It did help my computing skills with the web programming. It was something that I did take into high school. I don't see myself pursuing that as a career, but it helped me overcome a certain fear in the higher levels of computer functioning. (Respondent #3)

Section 3: Innovation Configuration for a Middle School Environmental Education Project

Hord et al.'s, (1987) Innovation Configuration (IC), a process from their Concerns-based Adoption Model (CBAM), was used as a medium for developing a model for a middle-school environmental education project. An IC can be a viable tool because it concretely describes desired, acceptable, and unacceptable behavior of teachers and students who are using an innovation. The proposed environmental model has been developed using the background information of the Mission Environment (ME) project, data from student interviews, data from co-developer interviews, and data from the literature review.

Hord et al. (1987) wrote that an innovation configuration is a process used to portray an educational program in operational terms and represents the patterns of innovation described by teachers using the program in their classrooms. The operational features, termed components, are based on materials, teacher behaviors, and student

activities. Variations of each component represent different methods teachers employ in the implementation of an innovation. Over time, it is possible to determine those components that are identified most often. It is also possible to identify the teachers who are incorporating the same or similar configurations, as well as those who are not.

From this input, a checklist can be constructed to communicate a description of the program and to articulate the expectations of the program. Minimum criteria are established from the checklist which would then enable a teacher to be classified as a user (Wright-Jones, 1999).

Procedures for Designing an Innovation Configuration

Before outlining the procedures for designing an innovation configuration, it is important to define the terms. The terms below have been used by Heck (1981), Hord et al. (1987), and Wright-Jones (1999).

Definitions of Terms

Checklist: A tool for identifying specific components or parts of an innovation and the variations that may develop while being used in classrooms or schools.

Components: The major operational features or parts of an innovation. They are usually based upon materials, teacher strategies, and student activities.

Critical Components: Those components which are determined to be essential to an innovation.

Dimensions: The characteristics of a component which may be used alone or in combination to make variations in a component. It is an attribute by which one component

may differ from another.

Fidelity: How closely teachers follow a program as it was envisioned by an innovation developer.

Innovation Configurations (IC): Represent the patterns of innovation use that result when different teachers implement innovations in their classrooms.

Related Components: Those components which are not considered essential to an innovation.

Variations: The different ways a teacher may implement components of an innovation in a classroom setting.

Procedure

From a study conducted by Heck (1981), it was determined that the development of an innovation configuration involves five steps: (a) identifying innovation components, (b) verification of components and variations, (c) refinement of checklist, (d) data collection, and (e) data analysis.

Step 1: Identifying Innovation Components

Component identification begins by reading descriptive materials about the program. Next the developer, program facilitator, or curriculum coordinator is interviewed to discover a concise understanding of what constitutes the innovation. During this process, a tentative list of components and a few variations for each component are identified.

Step 2: Verification of Components and Variations

After the developer is interviewed, observations and interviews are conducted of users to determine what users are doing as they implement and combine components. At this point, users are questioned as to what they consider essential components to the innovation. As many different users as possible are interviewed to gain a complete picture of the variations. The initial checklist is expanded during this step.

Step 3: Refinement of Checklist

The checklist is further defined through new discussions with the developer. The most important components and variations are clarified. Discrepancies between developer and user are resolved. Questions and probes to ask of users are added. Language and format are standardized, and the checklist is made ready for completion by users.

Step 4: Data Collection

Using the data generated from interviews, observations, and/or self-administered checklists, the components are analyzed, and delineation of Configurations is established. A checklist is best completed by the user and best utilized with innovations that are simple. More complex innovations require the more detailed information that can be obtained through interviews. During this step, additional variations of components can also be acquired and added to the checklist.

Step 5: Data Analysis

The data are analyzed by the use of a computer or manual computation of component frequencies. From the raw tallies, profiles can be created which describe how

components are used by teachers in a variety of settings, such as teams, grades, schools, or districts. These profiles can be used both for reporting and for planning teacher training.

Developing an Innovation Configuration for an Environmental Education Project

Since the Mission Environment project is no longer being taught, the innovation configuration could not be created using the steps that would be followed for an innovation currently being implemented. Thus this IC was generated through a review of background material and interviews with the co-teacher of the project using a modified version of the preceding five steps: (a) identify the innovation components and establish an initial checklist, (b) verify and expand the innovation components (c) consult a curriculum developer for expert input to refine the checklist and add the variations, and (d) edit and revise the expanded checklist to produce a final draft IC.

Step 1: Identifying the Innovation Components

To begin the process of developing a checklist, I reviewed the background material written in the first chapter of this dissertation. Reflecting back on the ME project, my co-teacher and I developed a list of major components which we felt would be important for a middle-school environmental education project. In this process, we answered the following questions:

1. What did the innovation look like when it was implemented? What did we see ourselves and our students doing?
2. What were the major components of ME as it was taught?

The initial checklist that resulted from this review and interview is shown in Table 12.

Table 12

Initially Identified Components of a Middle-School Environmental Education Project

Component	Description
1	The focus on learning activities outside the classroom (Outdoor Ed)
2	The use of the theory of constructivism in the development of student-directed studies.
3	An emphasis on environmental education.
4	Partnerships with community agencies.
5	The focus on service-learning.
6	The development of units of study that are interdisciplinary.
7	An emphasis on learning activities that were cooperative in nature.
8	Opportunities for public speaking and presentations.
9	Integration of technology into the whole learning environment.
10	An authentic assessment system.

Step 2: Verify and Expand the Innovation Components

Since this project is no longer being taught, observing the innovation in use or interviewing any of the users was not possible. Therefore, I went back to the transcribed student interviews to see if there were any components that were missed in the initial checklist generated by my reflections and those of my co-teacher. Data from the student interviews provided the rationale for the life skills component of the IC. The literature review also revealed the importance of planned student reflection in environmental and service learning projects.

An edited list emerged that outlined the components of the environmental education project as shown in Table 13.

Table 13

Edited List of Initially Identified Components of a Middle-School Environmental Education Project

Component	Description
1	Experiential/Hands-on Education
2	Outdoor Education
3	Student-Directed
4	Community Partnerships
5	Service-Learning
6	Integrated Curriculum
7	Cooperative Learning/Team-Building
8	Technology Integrated
9	Reflection
10	Standards-Based
11	Parent/Administrative Support
12	Authentic Assessment
13	Project-Based
14	Life Skills

Step 3: Refinement of Checklist

The revised checklist was reviewed by a curriculum consultant, Dr. Ingrid Wright-Jones, the vice-principal of A. W. Spalding during the time I was developing the IC, who helped us refine the edited list of initially identified components of a middle-school environmental education project. Dr. Wright-Jones, my co-teacher, and I then discussed each component of the IC and determined the component variations which could be considered acceptable, most desired, or unacceptable.

On the basis of this input, and in addition to the developer/user reflections, a first draft of the Innovation Configuration was created as shown in Table 14.

Table 14

*First Draft of Innovation Configuration for
a Middle-School Environmental Education Project*

Components	Variations	
Experiential	a.	All areas of the curriculum are hands-on
	b.	The majority of the curriculum is hands-on
	c.	Hands-on involvement happens once or twice a week
Outdoor Education	a.	Learning happens out of the classroom every day
	b.	Learning happens out of the classroom at least twice per week
	c.	Learning happens out of the classroom once per month
Student-directed	a.	Students' interests, questions, and inquiry directs the curriculum a majority of the time. Each member of the group is focused and involved.
	b.	Students' interests, questions, and inquiry often direct the curriculum. Each member of the group is focused and involved.
	c.	Teacher directs curriculum with minor or no input from students.
Community Partnerships	a.	Networking with a variety of outside entities—city, county, state, federal, service organizations, and private businesses.
	b.	Networking with local businesses and organizations.
	c.	Local business giving some financial support.
Service Learning	a.	A variety of long-term, on-going service projects.
	b.	A long-term, on-going service project.
	c.	Service project is incidental and spasmodic.
Integrated Curriculum	a.	All disciplines are integrated.
	b.	At least 2-3 disciplines are integrated.
	c.	Each discipline is taught separately.
Cooperative Learning	a.	Students work in cooperative groups the majority of the time. Team-building happens daily.
	b.	Students work in cooperative groups for half of the day. Team-building happens at least once a week.
	c.	Students seldom work in groups and team-building happens once a year.

Table 14—Continued

Technology	a.	Technology is integrated in all projects.
	b.	Technology is integrated in most projects.
	c.	A computer lab is used two class periods a week for work on projects.
Reflection	a.	Daily reflection after each activity.
	b.	Reflection at least once a day.
	c.	Reflection is unplanned and seldom occurs.
Standards-based	a.	All learning activities address clearly defined standards and are tracked. Standards are written in student-friendly language; students can reflect on and articulate the standards addressed in their learning experiences.
	b.	All learning activities address clearly defined standards.
	c.	An attempt is made to fit standards to what has already been completed. Standards are not considered when learning activities are planned.
Support—Internal and External	a.	Support from district, board, administration, parents, and total community.
	b.	Support from both administration and parents.
	c.	Support from only one entity
Authentic Assessment	a.	Most assessments are product or performance. Students also do self-evaluations on a regular basis.
	b.	Some of the assessments are product or performance. Students occasionally do self-evaluations.
	c.	A majority of assessments are paper and pencil tests.
Project-based	a.	All learning is project-based.
		Most learning is project-based.
		Occasional learning is project-based.
Life Skills	a.	Students demonstrate mature life skills development and application (managing time, setting goals, exercising leadership roles, applying research skills) in all learning experiences.
	b.	Student demonstrate growth in life skills development and application (managing time, setting goals, exercising leadership roles, applying research skills) in all learning experiences.
	c.	Life skills is taught as a class with little practical application.

Step 4: Produce a Final Draft of the Innovation Configuration

The first-draft IC needed to be edited, so copies were given to the consultant, my co-teacher, and a classroom teacher for further input. As we considered the implications of this IC, it became apparent that we had created a model for a total school program rather than a model for an environmental education project. Further study of the literature review also revealed another component that needed to be added to the innovation configuration—Participatory Action Research (PAR).

Consequently, the IC was revised to reflect these changes. A model emerged that we believe can be integrated into a typical school curriculum. It is a model that could be on-going throughout a school year, and scheduled to be part of a school day. It was our consensus that this model could be adopted by most middle schools. The final draft is shown in Table 15.

Analysis of the Mission Environment Project

Curriculum for the Mission Environment project was developed over a period of 3 years. Both my co-teacher and I knew what kind of learning we wanted to provide for our students. Our view of “school” was vastly different from the traditional concept of students sitting at desks in orderly rows.

Because we both had a passion for outdoor education, we wanted most of the learning to be hands-on, and outside the classroom, in the real world. We also wanted our students to be involved in service to their community. Besides these broad goals, the

Table 15

*Final Draft of Innovation Configuration for
A Middle-School Environmental Education Project*

Components	Variations	
Experiential	a.	All learning activities are hands-on
	b.	The majority of the activities are hands-on
	c.	Hands-on involvement happens once or twice a week
Outdoor Education	a.	At least one learning activity happens out of the classroom each day the project is taught.
	b.	Learning activities occur out of the classroom every other day the project is taught.
	c.	Learning activities seldom occur out of the classroom.
Student-directed	a.	Students' interests, questions, and inquiry direct the project a majority of the time. Students are focused and involved.
	b.	Students' interests, questions, and inquiry often direct the project. Students are focused and involved.
	c.	Teacher directs project with minor or no input from students.
Community Partnerships	a.	Networking with a variety of outside entities—city, county, state, federal, service organizations, and private businesses.
	b.	Networking with local businesses and organizations.
	c.	Local business giving some financial support.
Service Learning	a.	Service component is an on-going, integral part of the project for the duration of the project.
	b.	Service component does not continue for the duration of the project .
	c.	Service component is incidental and spasmodic.
Integrated Curriculum	a.	All disciplines are integrated in the project.
	b.	At least 2-3 disciplines are integrated in the project.
	c.	No integration of disciplines in the project.

Table 15—Continued

Cooperative Learning	a.	Students work in cooperative groups the majority of the time for the project. Class/team-building happens each day the project is taught.
	b.	Students work in cooperative groups for half of the time for the project. Class/team-building happens at least once a week.
	c.	Students seldom work in groups, and class/team-building happens once a year.
Technology	a.	Technology is integrated in all aspects of the project.
	b.	Technology is integrated in most aspects of the project.
	c.	Technology is not integrated in the project.
Reflection	a.	Reflection occurs each day the project is taught.
	b.	Reflection occurs at least once a week.
	c.	Reflection is unplanned and seldom occurs.
Standards-based	a.	All project learning activities address clearly defined standards and are tracked. Standards are written in student-friendly language; students can reflect on and articulate the standards addressed in their learning experiences.
	b.	All project learning activities address clearly defined standards.
	c.	An attempt is made to fit standards to what has already been completed. Standards are not considered when project learning activities are planned.
Support—Internal and External	a.	Support from district, board, administration, parents, and total community.
	b.	Support from both administration and parents.
	c.	Support from only one entity
Authentic Assessment	a.	Most assessments are product or performance-based. Students also do self-evaluations on a regular basis.
	b.	Some of the assessments are product or performance-based. Students occasionally do self-evaluations.
	c.	A majority of assessments are paper and pencil tests. No self-evaluations.
Project-based	a.	All learning activities are developed as individual and team projects.
	b.	Most learning activities are project-based.
	c.	Learning activities are seldom project-based.

Table 15—Continued

Life Skills	a.	Life skills development and application (managing time, setting goals, exercising leadership roles) are completely integrated in the project and students demonstrate growth as they participate in the project.
	b.	Life skills development and application (managing time, setting goals, exercising leadership roles) are occasionally integrated in the project, and students demonstrate some growth as they participate in project.
	c.	Life skills are taught as a separate class and are not integrated into project expectations.
Participatory Action Research	a.	Students use at least three methods: interviews, on-site observations, monitoring of environmental conditions, mapping, oral histories, collaborative planning sessions, etc., to research a problem and determine possible solutions. They then apply their knowledge to solve a problem.
	b.	Students use at least two methods to research a problem and determine possible solutions. They then apply their knowledge to solve a problem.
	c.	Students research using only one method to find solutions to a problem. There is no action taken.

following objectives, adapted from Susan Kovalik's Integrated Thematic Instruction

Model, were established for the project:

1. To help our students learn to express their ideas verbally and in writing
2. To help our students learn to manage and be accountable for their time
3. To help our students identify and organize information and resources
4. To provide an opportunity for students to learn skills which will help them live in a dynamic, entrepreneurial society
5. To provide an opportunity for students to produce something which will have a positive impact on their community
6. To provide hands-on, inquiry-based learning

7. To help students make connections between themselves, the content, and the larger world

8. To create an atmosphere in which the teacher is the facilitator and where students and teachers work as a team.

In addition to the basic skills of reading, writing, and math, we proposed that listening, speaking, and thinking skills would be part of the curriculum. Using the U. S. Department of Labor Secretary's Commission on Achieving Necessary Skills (SCANS, 1991) report, as a guide, the following skills were to be taught:

1. Decision-making
2. Problem-solving
3. Locating, organizing, and processing information
4. Technology skills
5. Character development: responsibility, self-management, integrity, honesty, and positive self-esteem.

We decided that all of these skills would be taught with students working in teams. The teachers' jobs were to teach the skills the students needed to help them succeed. Student accountability for completing projects was to be peer-based, according to a team-developed schedule.

As the project evolved over the years, my co-teacher and I reflected often on the program and made adjustments as they were needed. And now, 4 years after the end of ME, we can conclude that most of the goals for our students were realized. However, there were several weaknesses that need to be addressed if a similar project is implemented.

1. We did not have the support of all of the parents and the students. This problem could have been somewhat ameliorated with a better system of communication, such as weekly or monthly newsletters and regularly scheduled parent meetings.

2. Two missing critical components of the project were regular reflection by the students and a process for action research. Reflection usually occurred during spontaneous class discussions. Regular, planned journaling would have expanded the learning benefits for students and teachers. The students identified problems, researched solutions, and put their solutions into action, but the process was not well organized in step-by-step procedures.

3. The administration and school board supported our project, but basically in words only. We received little financial help to cover several important aspects of our proposal, such as the necessary technology, renovation of classroom space, transportation costs for field trips, and teacher aides. A solution to this problem might also have been better communication. Even though we did make an effort to include the administration in our planning, it was not done on a consistent basis.

All of these weaknesses have been addressed in the IC for a Middle School Environmental Education Project.

Summary of Chapter 4

The findings from the survey data suggest that the ME students reported more positive than negative attitudes, behavior, and affect towards the environment. The ME students reported more positive attitudes, behavior, and affect towards the environment

than the non-participating students.

The findings from the interview data support the survey data and include further evidence that the participating students not only developed positive attitudes and behavior towards the environment, but that they also acquired additional benefits from the Mission Environment program. These additional benefits include such things as a greater awareness of responsibility for community service, a love of learning, development of skills through hands-on experiences, a sense of accomplishment, opportunities for leadership development, opportunities to develop collaboration skills and to explore career options.

An Innovation Configuration for a Middle School Environmental Education project was created employing data from the student interviews, data from reflective interviews with the co-developer of the ME project, guidance from a curriculum expert, and information provided in the literature review. This model includes the essential elements of the ME project, as well as components which have been chosen, through a process of reflection and research, to provide the ideal learning experience for this kind of project.

CHAPTER FIVE

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS FOR FUTURE RESEARCH

The purpose of this chapter is to summarize the study, state the findings and conclusions, and discuss the recommendations for further study.

Summary

The primary purpose of this causal-comparative study was to examine the long-term effects of an eighth-grade environmental education project with respect to reported environmental attitude and behavior. The project, Mission Environment (ME), existed from 1996 to 2000 and incorporated the principles of experiential, outdoor education. Students were engaged in a variety of hands-on learning experiences including outdoor field studies, cooperative team activities, the establishment of a classroom museum, oral presentations, video production, and finally, a collaborative effort with the city government to construct a greenway along a local creek.

To determine the long-term effects of the ME project on student attitudes and behavior, a self-administered, self-report questionnaire was administered to the 2001 senior class of Collegedale Academy. The survey instrument, Scale for the Measurement of Ecological Attitudes and Knowledge (MEAK; Maloney et al., 1975), consisted of 45

questions and was divided into five sections: demographic information, attitude, behavior, affect, and knowledge.

Of the 75 surveys completed, 4 were disqualified because some of the demographic information was omitted, so the data from 71 surveys were included in this study. Of that total, 28 indicated participation in the ME project during their eighth-grade year (1996-1997), and the remaining 43 indicated non-participation in ME. These two groups were compared to see if there was a statistically significant difference in their total scores, attitude scores, and behavior scores.

In addition to the survey, three students who had participated in the ME project were interviewed using a semi-structured approach, to discover their personal feelings about the project. They discussed how their participation has subsequently impacted their current environmental attitudes and practices, as well as the project's impact on their school experiences and career choices.

And finally, Innovation Configuration (Hord et al., 1987) interview questions, along with the literature review, data from the student interviews, and historical data from the ME project were used to create a model, an Innovation Configuration, for a middle-school environmental education project. This model identifies the critical components of the project and concretely describes desired, acceptable, or unacceptable behavior of teachers and students who are using the innovation.

Quantitative Findings

A student's test for independent samples was conducted to evaluate research hypotheses 1 through 5 and sub-hypotheses 2.1-2.10 and 4.1-4.10. Chi square was used to

test sub-hypotheses 3.1-3.10 and 5.1-5.15.

The five research hypotheses, four sub-hypotheses, and results of the data analysis are listed below:

Hypothesis 1: There is a statistically significant difference between ME participants and non-participants in total attitude scores as measured by MEAK.

To test research hypothesis #1, the following null hypothesis was tested: There is no statistically significant difference between ME participants and non-participants in attitude as measured by the self-administered MEAK survey.

A student's test for independent samples was performed on the mean scores for survey Section 1, which measures attitude. The null hypothesis is rejected, $t(69)=-2.107$, $p<.05$. The ME students ($M=31.96$, $SD=7.75$) on the average scored higher than the non-participating students ($M=27.56$, $SD=9.12$).

Sub-Hypotheses 1.1-1.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in MEAK Section 1, which measured attitudes.

To test research sub-hypotheses 1.1-1.10, the following null hypothesis was tested. There is no statistically significant difference between ME participants and non-participants in their responses to each of the 10 items in MEAK Section 1, which measures attitude.

The student's independent samples t test was used to test sub-hypotheses 1.1-1.10. The null hypothesis is rejected for responses 1.1, 1.5, 1.6, and 1.10 which are statistically significant at $p < .05$. Statement 1.1 reads: "I'd be willing to ride a bicycle or take a bus to work in order to reduce air pollution." Statement 1.5 reads: "I'm really not willing to go

out of my way to do much about ecology since that's the government's job." Statement 1.6 reads: "I would donate a day's pay to a foundation to help improve the environment." Statement 1.10 reads: "I would not be willing to pay a pollution tax even if it would considerably decrease the smog problem." Statements 1.5 and 1.10 were negatively connoted on the survey and the responses were scored accordingly.

Hypothesis 2: There is a statistically significant difference between ME participants and non-participants in total behavior scores as measured by MEAK.

To test research hypothesis #2, the following null hypothesis was tested: There is no statistically significant difference between ME students and non-participating students in behavior as measured by MEAK. The student's test for independent samples was performed on the mean scores of the MEAK survey, Section 2, which measured behavior. The null hypothesis is rejected, $t(69)=4.45$, $p<.00$. ME students ($M=13.22$, $SD=2.51$) on the average scored higher than the non-participating students ($M=11.32$, $SD=1.25$).

Sub-Hypotheses 2.1-2.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in MEAK Section 2, which measured behavior.

To test research sub-hypotheses 2.1-2.10, the following null hypothesis was tested: There is no statistically significant difference between ME participants and non-participants in their responses to each of the 10 items in MEAK Section 2, which measures behavior.

Chi square was used to test hypothesis 2.1-2.10. The null hypothesis is rejected for responses 2.1, 2.2, 2.3, 2.5, 2.6, 2.7, and 2.10 which are statistically significant at $p<.05$. Statement 2.1 reads: "I guess I've never actually bought a product because it had a lower

polluting effect.” Statement 2.2 reads: “I keep track of my congressman and senator’s voting records on environmental issues.” Statement 2.3 reads: “I have never written a congressman concerning the pollution problems.” Statement 2.5 reads: “I don’t make a special effort to buy products in recyclable containers.” Statement 2.6 reads: “I have attended a meeting of an organization specifically concerned with bettering the environment.” Statement 2.7 reads: “I have switched products for ecological reasons.” Statement 2.10 reads: “I subscribe to ecological publications.” Statements 2.1, 2.3, and 2.5 were negatively connoted on the survey and were scored accordingly.

Hypothesis 3: There is a statistically significant difference between ME participants and non-participants in total affect scores as measured by MEAK.

To test research hypothesis #3, the following null hypothesis was tested: There is no statistically significant difference between ME students and non-participating students in affect as measured by MEAK. The student’s test for independent samples was performed on the mean scores of MEAK Section 3, which measured affect. The null hypothesis is rejected, $t(69)=1.969$, $p<.05$. The ME students on the average scored higher, $M=33.21$, $SD=9.21$, than the non-participating students, $M=29.12$, $SD=8.66$.

Sub-Hypotheses 3.1-3.10: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 10 items measured in MEAK Section 3, which measured affect.

To test research sub-hypotheses 3.1-3.10, the following null hypothesis was tested. There is no statistically significant difference between ME participants and non-participants in their responses to each of the 10 items in MEAK Section 3, which measures affect.

The student's independent samples *t* test was used to test sub-hypotheses 3.1-3.10. The null hypothesis is rejected for responses 3.1 and 3.3 which are statistically significant at $p < .05$. Statement 3.1 reads: "I feel people worry too much about pesticides on food products." Statement 3.3 reads: "It genuinely infuriates me to think that the government doesn't do more to help control pollution of the environment." Statement 3.1 was negatively connoted on the survey and was scored accordingly.

Hypothesis 4: There is a statistically significant difference between ME participants and non-participants in total knowledge scores as measured by MEAK.

To test research hypothesis #4, the following null hypothesis was tested: There is no statistically significant difference between ME students and non-participating students in total knowledge scores as measured by MEAK. Chi square was performed on the mean scores of MEAK Section 4, which measured knowledge. The null hypothesis is accepted, $t(69)=1.599, p > .05$. The ME students on the average scored higher, $M=20.57, SD=9.21$, than the non-participating students, $M=17.05, SD=8.99$, but the difference was not statistically significant.

Sub-Hypotheses 4.1-4.15: There is a statistically significant difference between ME participants and non-participants in the responses to each of the 15 items measured in MEAK Section 4, which measured knowledge.

To test research sub-hypotheses 4.1-4.15, the following null hypothesis was tested. There is no statistically significant difference between ME participants and non-participants in their responses to each of the 15 items in MEAK Section 4, which measures knowledge.

Chi square was used to test sub-hypotheses 4.1-4.15. The null hypothesis is

accepted for all 15 responses for MEAK Section 4.

Hypothesis 5: ME participants will have higher total scores than non-participants as measured by the self-administered survey for Measurement of Ecological Attitudes and Knowledge (MEAK).

To test research hypothesis #5, the following null hypothesis was tested: There is no statistically significant difference in total MEAK scores between ME participants and non-participants as measured by the self-administered MEAK survey.

The null hypothesis is rejected, $t(69)=-2.904, p<.05$. The student's test for independent samples was performed on the mean total scores of the MEAK survey. The participating students ($M=98.89, SD=18.93$) on the average have higher total scores than the non-participating students ($M=85.05, SD=20.07$).

Qualitative Findings

Student Interview Results

The interview data revealed further evidence that the ME project had long-term effects on three of the participating students. The interviews seem to suggest that the students acquired other benefits from the project including: (a) a greater awareness of responsibility for community service, (b) a love of learning, (c) development of skills through hands-on experiences, (d) a sense of accomplishment, (e) opportunities for leadership development, (f) opportunities to develop collaborative skills, and (g) opportunities to explore career options.

Innovation Configuration Results

Innovation Configuration (Hord et al., 1987) interview questions, along with the literature review, student interview data, and historical data from the ME project were used to create an Innovation Configuration, a model for a middle-school environmental education project. This model identifies the critical components of the project and concretely describes desired, acceptable, or unacceptable behavior of teachers and students who are using the innovation. I used the Innovation Configuration to do a reflective analysis of the ME project.

Whereas most of the goals for our students in the ME project were realized, there were several weaknesses that need to be addressed if a similar project is implemented:

(a) Support of all of the parents and the students was lacking, (b) two missing critical components of the project were regular reflection by the students and a process for action research (reflection usually occurred during spontaneous class discussions, rather than regular, planned journaling), and (c) the administration and school board supported our project verbally, but not financially.

Conclusions

Through my review of the literature and the data from my study, I have drawn several conclusions which may assist those who plan environmental education programs and develop curriculum for schools. These conclusions are embodied in the following categories: (a) positive environmental attitudes and behaviors, (b) life-long skills and character development, and (c) environmental project innovation configuration.

Positive Environmental Attitudes and Behavior

Schools should involve students in environmental education projects like ME.

Involving students in such environmental projects could have long-term effects in fostering positive attitudes and behaviors towards the environment. I am drawing this conclusion from the fact that students who were involved in ME reported positive attitudes and behaviors 4 years after the project ended, as determined by the survey data relative to research hypotheses 3 and 4. Additionally, the interview data documented current positive conservation attitudes and behavior of three ME students, which they attributed to their participation in the ME project 4 years ago.

The data analysis for Section 4, which measured knowledge, indicated that there was no statistically significant difference between the two groups of students in the mean scores, or in the individual responses. Conversely, the data analysis of Section 2, which measured behavior, revealed the highest number of statistically significant responses. All statistically significant differences in Section 2 were in favor of positive behaviors for participating students. From these findings, it could be conjectured that the possession of knowledge about the environment is not necessarily an indicator of positive conservation behavior. This conclusion is consistent with the findings of several researchers who suggest that environmentally relevant behaviors do not naturally evolve from knowledge, but appear to be the result of knowledge combined with the application of action strategy skills (Disinger & Monroe, 1994; Leeming et al., 1993). I believe that this focus on action skills, which was a major component in the ME project, contributed to the long-term positive conservation behaviors reported by the participating students.

The response pattern analysis of Section 2 also indicated that ME students reported more positive consumer behaviors than non-participating students. These positive behaviors may be strong determinants of future improvements in environmental quality, since it is likely that such improvements will be driven more by consumer choice than by governmental mandate (Disinger & Monroe, 1994). It could be concluded that the ME project helped influence students to make positive lifestyle choices and to be responsible citizens, as they learned to consider the environmental impact of their consumer decisions.

Life-long Skills and Character Development

Student involvement in the ME project not only had a positive effect on students' attitudes and behavior towards the environment, but it also nurtured the development of life-long skills and character development. This was especially reflected in the data from the student interviews. They indicated that the project enhanced their skills in communication, collaboration, and leadership. Furthermore, involvement in the project nurtured creativity and developed a sense of responsibility. It even supported some of the career choices that these students have currently made in college.

Innovation Configuration

In reflecting back, 4 years after the project ended, I realized that whereas most of the goals for our students were achieved, there were weaknesses in the ME project. The usefulness of ME was limited:

1. Though it was a part of the eighth-grade curriculum, it was never adopted as an integral part of the entire school's curriculum.

2. We did not have the support of all parents and students. The administration and school board verbally supported our program, but provided little financial resources for its implementation.

3. Furthermore, though there were articles written and several presentations made about the project, no empirical data existed to operationally define the program and document its effectiveness. Thus, it was difficult for the program to be duplicated at other sites.

Recommendations

For Practice

Based on my review of the literature and the data gathered, I believe the following recommendations could be made as a result of the study of the Mission Environment project.

1. Schools should make intentional efforts to develop positive attitudes and behavior concerning the environment by involving students in environmental education projects such as ME.

2. Environmental education projects like ME should be operationally defined so that they could be effectively duplicated and implemented.

3. School systems should embed environmental education projects, such as ME, into the existing curriculum and support and sustain their implementation through policy adoption, budgetary appropriations, and allocation of time for staff development training.

4. Schools and universities should provide pre-service and in-service teacher training in integrating environmental education projects, such as ME, into their existing

curricula.

5. The Innovation Configuration, outlined in Chapter 4, should be used to develop and implement a middle school environmental education project.

For Further Research

Since few studies about the long-term effects of environmental education projects like ME exist, collecting empirical data on such projects as ME could add to the knowledge base concerning the development of positive environmental attitudes and behaviors among students. This research could take the form of a quasi-experimental study using a pre-test and post-test method to collect the data. In addition, data from such studies could be used to document the effectiveness of programs and increase the likelihood of replication in other schools.

APPENDIX A
EAGLE EYE, INC.

Eagle Eye Inc.

Extending the Classroom Into the Community

Every student who takes science needs to have experiences similar to those of scientists. Students should identify problems, create and implement solutions, bring projects to completion, and communicate the results.

As an Adventist science teacher, I also believe it is essential for students to experience the "joy of service."¹ For them to become responsible members of society, they must not only be exposed to adults involved in these meaningful and demanding tasks, but must also participate in such activities themselves.² Therefore, it is vital to connect science instruction to everyday life.

Students at Walker Memorial Junior Academy (WMJA) in Avon Park, Florida, learn, through service, to gain a personal

sense of purpose. By forming community partnerships, students can experience meaningful rewards and a sense of achievement through personal effort.

By extending the classroom into the community and providing hands-on cooperative problem-solving, I seek to bring students face to face with social and environmental issues and to create opportunities for them to become stewards of creation.

The outdoor classroom has become more than trips to the woods, fields, or stream. During field studies, learning occurs in the context of reality rather than being mediated by textbooks or videos.³ The outdoor classroom thus connects students with the affairs of their community.

To provide students with relevant work, an environmental monitoring project has been developed within the sophomore biology program at WMJA, where two teachers help with the project. Gordon Davis teaches grades 7 to 10, science, and physical education, and provides general guidance; and Stephen Roche, math and computer teacher for grades 7 to 10, serves as technology consultant. Partnerships have been formed with the University of Florida, Global Learning and Observations to Benefit the Environment (GLOBE),⁴ and the Highlands County Lakes Association. Eagle Eye Incorporated (EEI), a student-directed water-quality monitoring project, provides a community service and improves the environment.

By forming community partnerships, students can experience meaningful rewards and a sense of achievement through personal effort.

By Gordon Davis

The outdoor classroom has become more than trips to the woods, fields, or stream.

The Organization

The project is patterned after a corporate structure. Three officers—president, vice-president, and secretary—are elected at the beginning of the school year. These officers organize and direct the monthly meetings. EEI has four divisions: data retrieval, data control, lake restoration, and public relations, which are subdivided into departments. Division leaders provide leadership and management for the four divisions and their individual departments. All students, including the officers and leaders, are assigned to specific de-

partments, where they conduct the activities of that department.

The job descriptions of each division and its departments are as follows:

Data Retrieval has three departments: Lakewatch, Chemical Tests, and Benthic Macroinvertebrates. *Lakewatch* collects water samples once a month from Lake Lillian and Eagle Pond for both nitrate and phosphate analysis, and determines chlorophyll "a" content. It also calculates water clarity and depth, and conducts a site survey. These procedures are conducted under the direction and cooperation of the Florida Lakewatch Program at the University of Florida. *Chemical Tests* collects and analyzes monthly water samples, providing a monthly water-quality index. Nine tests are performed: temperature, dissolved oxygen, five-day biological oxygen demand, pH, fecal coliform, total solids, total nitrates and phosphates, and turbidity. This department works in cooperation with GLOBE and reports monthly hydrology data to the GLOBE Internet

server. The *Benthic Macroinvertebrate* department collects monthly bottom samples to determine the kinds of invertebrates found on the lake bottom. Using statistical analysis indices of sequential comparison, taxa richness, and diversity, this department also provides a monthly water-quality index.

Lake Restoration has two departments: Lake Management and Environmental History. Using information from Data Retrieval, *Lake Management* first identifies problems, then designs and implements solutions. For example, the students discovered storm water runoff. The members of Eagle Eye Inc. offered a partial solution by stenciling storm drains with this message: "Dumping here pollutes our lakes." Testing also revealed dumping of trash around the lake's watershed. Students designed a plan for collecting trash around the lake, bringing it back to school, and then sorting, weighing, and recycling it. The *Environmental History* department compiles a historical descrip-

Water Quality Index

Date: 8/28/98

Time: 10:30

Test Location: Lake Lillian

Data Gatherer(s): Margie Dunn & Michael Baker

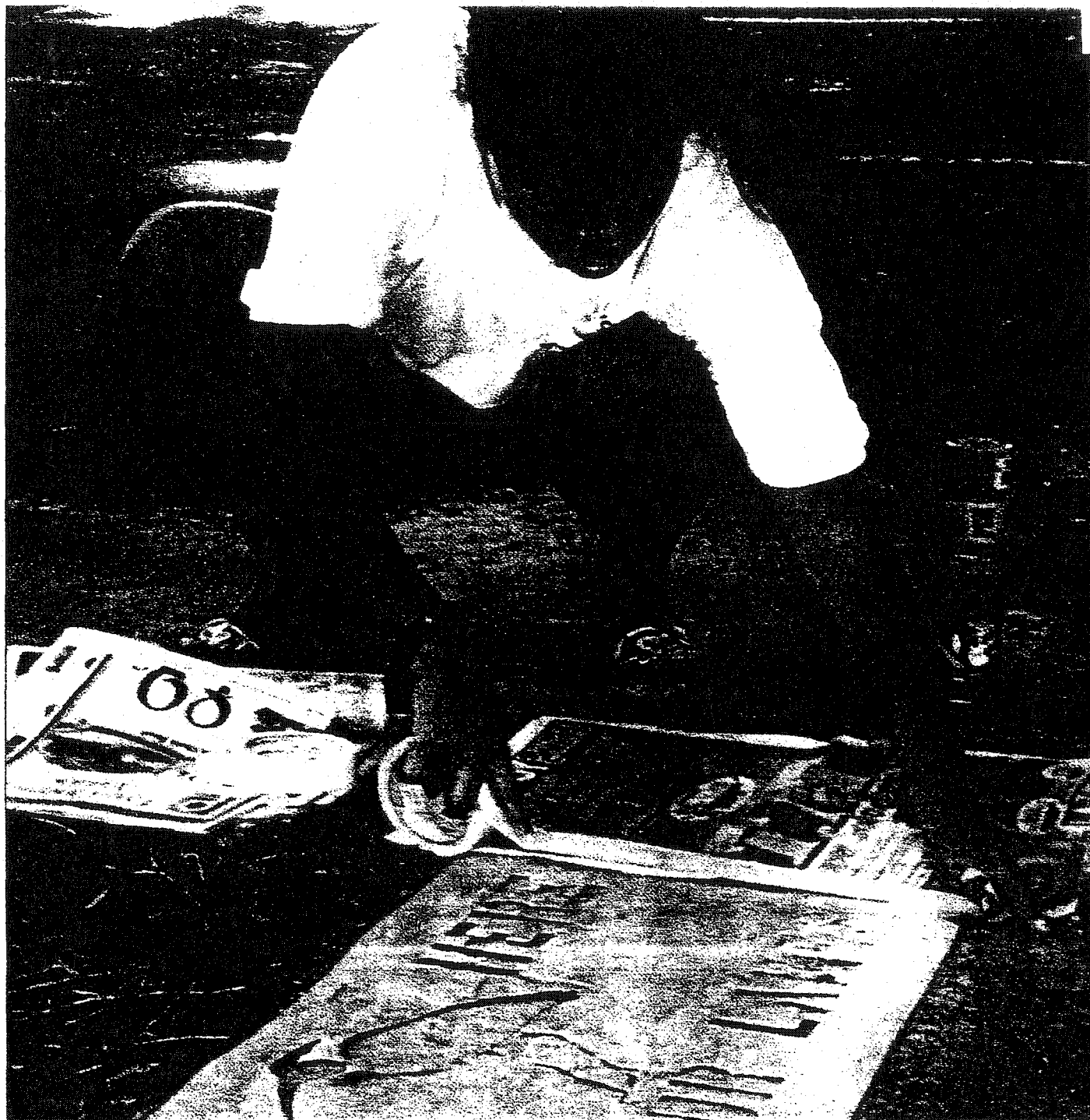
Weather Conditions: Sunny

	Test Results		Q-Value	Weighting Factor	Total
Dissolved Oxygen:	110%	% Saturation	96	0.17	16.32
Fecal Coliform:	0	Colonies/100mL	98	0.16	15.68
pH:	67	units	75	0.11	8.25
BOD:	7	mg/l	48	0.11	5.28
Temperature:	31	oC	10	0.1	1
Total Phosphate:	7.2	mg/l	100	0.1	10
Nitrates:	7.2	mg/l	100	0.1	10
Turbidity:	3'8"	NTU/feet	28	0.08	2.24
Total Solids:	0.1	mg/l	78	0.07	5.46

Water Quality Index Ranges

90-100	Excellent
70-90	Good
50-70	Medium
25-50	Bad
0-25	Very Bad

Overall Water Quality Index: 74.23
Water Quality: Good



To discourage people from dumping pollutants, Kim Talaa, vice-president of Eagle Eye Inc., prepares to stencil a storm drain that flows directly into Lake Lillian.

tion of the lakes from geological, social, and economical perspectives.

Data Control oversees the input of information into the appropriate spreadsheets and databases. This division supplies EEI with charts and tables for both monthly and year-end reports. It also ensures the safe storage of the data collected.

Public Relations has two departments, Promotions and Networking. Pro-

motions manages several large projects such as a monthly newsletter, press releases, multimedia presentations, and grant writing. *Networking* coordinates all communications between EEI and its constituency, using various forms of communication such as the World Wide Web, E-mail, faxes, and the postal service.

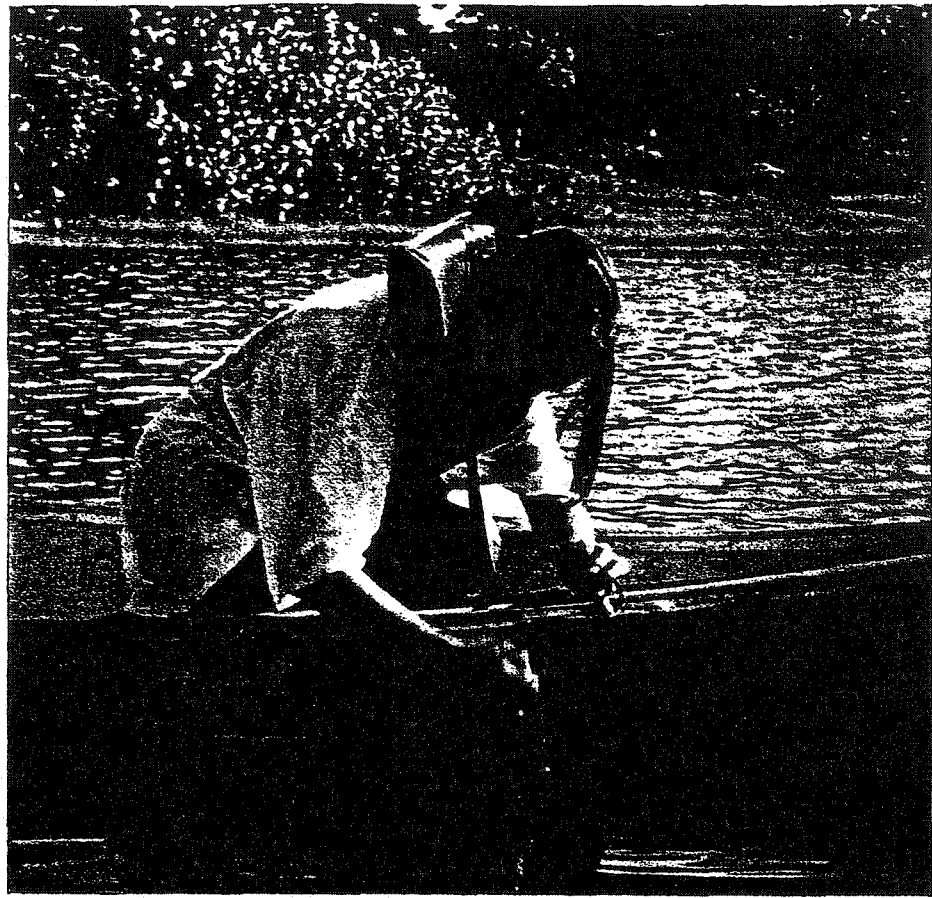
The Schedule

The logistics of this project could not

be managed without the aid and cooperation of the entire WMJA staff. The last Friday of every month, known as Expedition Day, the 10th-grade biology class is released from its normal schedule. Gordon Davis and Stephen Roche are also relieved of their regular classes.

In the morning, each grade has a block schedule so students can engage in projects that would not fit within a traditional schedule. The biology class is trans-

By extending the classroom into the community and providing hands-on cooperative problem-solving, I seek to bring students face to face with social and environmental issues and to create opportunities for them to become stewards of creation.



As part of data collection for the University of Florida's Lakewatch program, Desiree Rada calculates the monthly water depth of Lake Lillian.

formed into Eagle Eye Incorporated. The day starts with a corporate meeting, directed by the three corporate officers. Each student reports orally to the corporation about the previous month's accomplishments and discusses short-term goals. Upcoming events are also discussed. After the meeting, the students are dismissed to go about their individual responsibilities within EEI.

Integration

Because of the project's applied math and science emphasis, students have learned a great deal about these areas. It came as a surprise, however, that writing was so central to the success of this project—both in terms of amount and quality. From the obvious (a newsletter) to the more obscure areas (like explaining the correlating of data points in different charts), writing has been foundational to almost all aspects of the project. Everyone in EEI has to do some writing—of a type that is relevant to real life. For EEI to form necessary partnerships, letters to business, civic, government, and educa-

tional leaders must be done well. Communication through an extensive Web site allows the world to appraise the quality of the students' creative effort.

The need for artistic expertise also emerged. Corporate logos were needed for letterheads, business cards, envelopes, and the newsletter. The creative and artistic talents of several students were needed to develop a unique Web site design. Promotional displays featuring many aspects of EEI require a variety of artistic skills.

Oral presentations combine the skills of writing, artistic expression, and communication. Each student has the opportunity to share his or her experiences with fellow students and the community. In addition to the monthly meetings, the students also speak publicly about the work of EEI. They make formal and informal presentations at large conferences like the Florida Educational Technology Conference in Orlando, as well as to smaller local groups like the home owners' association, local public schools, and to the many guests who visit our campus on Expedition Day.

Technology plays an ever-increasing

role in the implementation and success of Eagle Eye Inc. Each aspect of the project requires some form of technology literacy. Software applications like Microsoft Word, Access, Excel, and PowerPoint make it possible for students to create and develop spreadsheets, databases, and multi-media presentations, and to write and design the many communication forms needed. Microsoft FrontPage gives the students the opportunity to design and manage a World Wide Web presence. Other computer applications give the students experience with scientific probe-ware and video editing. There are always technology problems to fix, and students, under the direction of Stephen Roche, solve those problems.

Conclusion

Eagle Eye Inc. allows students to initiate their own learning, participate in productive questioning, and probe for information they can use in real life rather than just to fill in the blanks on a test. These students have a voice in their society and form a vital part of their community.

EEI helps students understand the importance of science literacy, which goes beyond vocabulary, concepts, or procedural methods. It encourages a wholistic understanding of science, as they observe, infer, analyze, and predict outcomes. It enables them to be problem-solvers, and to find solutions for family, career, and community dilemmas. As they are trained in Christian service, our students learn to become leaders. To accomplish this goal, we must teach them to conceive ideas, not just mirror other people's thoughts, so they can successfully guide the future of the church and community."

A Christian school requires teachers with a vision, passion, and commitment who enjoy a challenge. It must prepare its students for the world out there and for eternity. Outdoor education makes an important contribution to this goal. ☺

Resources

Jane Healy:

Endangered Minds (New York: Simon and Schuster, 1990).

Your Child's Growing Mind (New York: Doubleday, 1994).

Failure to Connect (New York: Simon and Schuster, 1998).

National Science Teacher Association periodicals:

Science and Children

Science Scope

The Science Teacher

Association for Supervision and Curriculum Development periodicals:

Curriculum Report

Curriculum Update

Educational Leadership

Time Magazine, October 27, 1997

For the past 16 years, Gordon Davis has taught grades 7 to 10, science, and physical

education at Walker Memorial Junior Academy in Avon Park, Florida. In 1987, he received the Zapara Award for Excellence in Teaching, and in 1996, the Innovative Teaching Award from the Southern Union Conference of Seventh-day Adventists.

REFERENCES

1. Ellen G. White, *Education* (Mountain View, Calif.: Pacific Press Publ. Assn., 1952), p. 13.
2. Jane Healy, *Endangered Minds* (New York: Simon and Schuster, 1990), p. 286.
3. Amy Eckman, "Making Science Popular," *Curriculum Update* (Fall 1998), p. 7.
4. GLOBE is a worldwide network of scientists working together with students and teachers from more than 6,000 schools in 70 countries to study and understand the global environment.
5. Probeware includes scientific instruments such as a pH meter that collects data while connected to a computer. The computer's software allows for collecting, storing, graphing, printing, and analyzing the data.
6. White, p. 17.

LAKEWATCH Lake Lillian

Lake name/County:

Lillian/Highlands

Sampler:

Gordon Davis

Phone:

(941) 453-3131

Month/day/year:

9/29/98

Time:

3:43pm

Vanishing Point

Sun Code #

Sun Code Codes

Water Depth

Station 1: 8'2" ft.

1

1= full sun

22'7" ft.

Station 2: 10'2" ft.

1

2= haze over sun

12'10" ft.

Station 3: 9' ft.

1

3= thin cloud cover

16'6" ft.

4= medium cloud cover

5= heavy cloud cover

Wind from?:

sse

Wind strength:

weak

Wave height:

1

Inches

Wind speed:

none

mph

Pollen on lake:

little

Activity in your waters:

none

Strong winds:

none

Herbicides in lake:

none

Heavy boat traffic:

none

Large flocks of birds:

none

Rainfall from:

8/28/98

Lake level changes:

none

to:

9/29/98

184.15mm

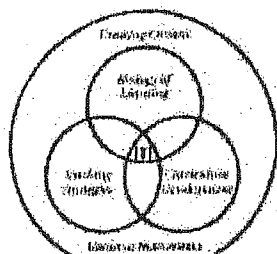
Anything else?:

none

Unusual weather:

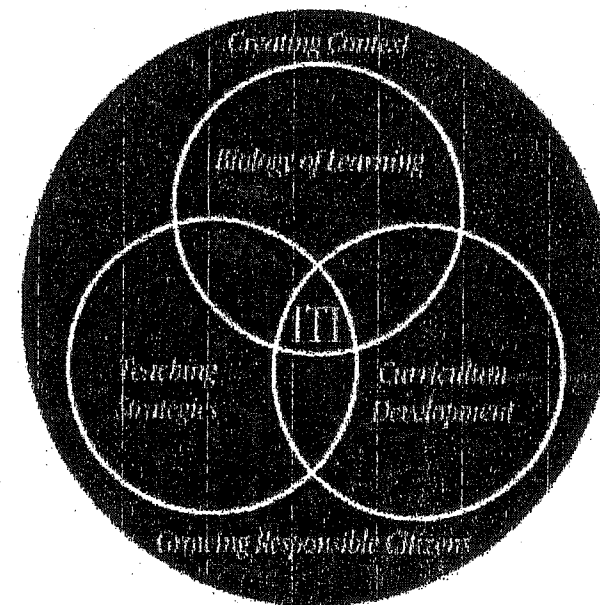
n/a

APPENDIX B
SUSAN KOVALIK'S THEMATIC INSTRUCTION
SCANS



ITI Overview

Three independent areas of best knowledge and best practice form the structure of the model.



1. Research on the biology of learning has given us a window on learning never before realized in the history of civilization.
 - o Translate the biology of learning into practical application
 - o Implement the nine bodybrain-compatible elements
2. Teaching strategies that align with the way the human brain learns have the greatest impact.
 - o Design the physical classroom to support long-term learning
 - o Create workable teams of students
 - o Develop classroom management that uses agreements, procedures, Lifelong Guidelines and LIFESKILLS
3. Curriculum development by classroom teachers makes learning come alive.
 - o Anchor curriculum to a yearlong theme and rationale
 - o Align district and state learning goals within the theme
 - o Orchestrate "being there" experiences tied to meaningful content
 - o Reach out to the community



The ITI model begins with an understanding of six learning principles derived from bodybrain research:

- Intelligence is a function of experience
- Emotions are the gatekeeper to learning
- Humans in all cultures use multiple intelligences to solve problems and to create products
- The brain's search for meaning is a search for patterns
- Learning is the acquisition of useful mental programs
- One's personality has an impact on learning

For more information on these brain research concepts, check out Kovalik Associate Ann Ross's [Explanation of ITI's Brain Research Concepts](#)

Once fully understood, Kovalik's ITI model leads educators to the nine bodybrain-compatible elements as a guide for applying the research through thoughtfully written curriculum and carefully selected teaching strategies:

1. Absence of Threat
2. Meaningful Content
3. Choices
4. Movement to Enhance Learning
5. Adequate Time
6. Enriched Environment
7. Collaboration
8. Immediate Feedback
9. Mastery (application level)

In an ITI classroom, students know what they are studying and why. The focus is on developing student understanding of important concepts, such as change, through curriculum that begins with a location or event in the student's world. As students investigate and conduct research to answer the big question, "What's going on around here?" the teacher ensures that state and local learner goals are addressed. At all times, the ITI teacher has answers for the pivotal questions, "So what?" and "Why do we have to learn this?" The teacher can answer Susan Kovalik's guiding question, "What do you want students to do with their understanding that leads to responsible citizenship?"

ITI classrooms and schools invite students to be there by their physical appearance and their strong sense of community. Students

and adults want to be there and express strong regret when they must be away. Both groups want to be a part of the fun and the important work of preparing responsible citizens.

At SK&A WE BELIEVE that students must possess:

- conceptual understanding of content
- basic skills and the foresight to know when to use them
- the ability to apply what is learned to "real world" situations
- capability to work collaboratively with others
- a vision of themselves as contributing members of society

What is ITI? Menu

[SK&A Home](#) | [ITI Information](#) | [What is ITI?](#) | [General Overview](#) |
[Guidelines LIFESKILLS](#) | [FAQs About ITI](#) | [ITI Resource Material](#) |
[Gold Medal Winners](#) | [Featured Schools](#) | [School Reform Models](#)

Kovalik Main Menu

[SK&A Home](#) | [Susan Kovalik](#) | [Associates](#) | [Schedule](#) | [ITI Information](#) |
[Mail List Registration](#) | [Associate Articles](#) | [Summer Events](#) | [Featured Schools](#) |
[School Reform Models](#) | [SK&A Online](#) | [Leadership Listserve](#) | [Books 4 Educators](#) | [Email SK&A](#)

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Covington, Washington 98042

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Fax: 253-631-7500

Email us at:
Nicole McNeil-Miller, CEO



Web Development
and Hosting by



Academic Innovations

Secretary's Commission on Achieving Necessary Skills (SCANS): Final Report Available

What Work Requires of Schools is the title of the initial SCANS report. This 61 page report defines the five competencies and three-part foundation that constitute the SCANS skills. Single copies are available for \$31.50, plus \$4 for handling from: National Technical Information Service (NTIS), Technology Administration, U.S. Department of Commerce, Springfield, VA 22161, 1-800-553-6847, NTIS Order Number: PB92-146711INZ. This product may also be ordered by fax at (703) 321-8547, or by e-mail at orders@ntis.fedworld.gov

The SCANS Skills and Competencies: an Overview

The Secretary's Commission on Achieving Necessary Skills (SCANS) was appointed by the Secretary of Labor to determine the skills our young people need to succeed in the world of work. The Commission's fundamental purpose is to encourage a high-performance economy characterized by high-skill, high-wage employment.

The primary objective is to help teachers understand how curriculum and instruction must change to enable students to develop those high performance skills needed to succeed in the high performance workplace.

SCANS has focused on one important aspect of schooling: what they called "learning a living" system. In 1991, they issued their initial report, *What Work Requires of Schools*. As outlined in that report, a high-performance workplace requires workers who have a solid foundation in the basic literacy and computational skills, in the thinking skills necessary to put knowledge to work, and in the personal qualities that make workers dedicated and trustworthy.

High-performance workplaces also require other competencies: the ability to manage resources, to work amicably and productively with others, to acquire and use information, to master complex systems, and to work with a variety of technologies.

This document outlines both these "fundamental skills" and "workplace competencies"

A Three-Part Foundation

Basic Skills:

Reads, writes, performs arithmetic and mathematical operations, listens and speaks

- A. Reading-locates, understands, and interprets written information in prose and in

documents such as manuals, graphs, and schedules

- B. Writing—communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts
- C. Arithmetic/Mathematics—performs basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques
- D. Listening—receives, attends to, interprets, and responds to verbal messages and other cues
- E. Speaking—organizes ideas and communicates orally

Thinking Skills:

Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn, and reasons

- A. Creative Thinking—generates new ideas
- B. Decision Making—specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative
- C. Problem Solving—recognizes problems and devises and implements plan of action
- D. Seeing Things in the Mind's Eye—organizes, and processes symbols, pictures, graphs, objects, and other information
- E. Knowing How to Learn—uses efficient learning techniques to acquire and apply new knowledge and skills
- F. Reasoning—discovers a rule or principle underlying the relationship between two or objects and applies it when solving a problem

Personal Qualities:

Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty

- A. Responsibility—exerts a high level of effort and perseveres towards goal attainment
- B. Self-Esteem—believes in own self-worth and maintains a positive view of self
- C. Sociability—demonstrates understanding, friendliness, adaptability, empathy, and
- D. Self-Management—assesses self accurately, sets personal goals, monitors progress, and exhibits self-control
- E. Integrity/Honesty—chooses ethical courses of action

Five Workplace Competencies

Resources:

Identifies, organizes, plans, and allocates resources

- A. Time—Selects goal-relevant activities, ranks them, allocates time, and prepares and follows schedules
- B. Money—Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives
- C. Material and Facilities—Acquires, stores, allocates, and uses materials or space efficiently

- *D. Human Resources*--Assesses skills and distributes work accordingly, evaluates performance and provides feedback

Interpersonal:

Works with others

- *A. Participates as Member of a Team*--contributes to group effort
- *B. Teaches Others New Skills*
- *C. Serves Clients/Customers*--works to satisfy customers' expectations
- *D. Exercises Leadership*--communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies
- *E. Negotiates*--works toward agreements involving exchange of resources, resolves divergent interests
- *F. Works with Diversity*--works well with men and women from diverse backgrounds

Information:

Acquires and uses information

- *A. Acquires and Evaluates Information*
- *B. Organizes and Maintains Information*
- *C. Interprets and Communicates Information*
- *D. Uses Computers to Process Information*

Systems:

Understands complex inter-relationships

- *A. Understands Systems*--knows how social, organizational, and technological systems work and operates effectively with them
- *B. Monitors and Corrects Performance*--distinguishes trends, predicts impacts on systems operations, diagnoses deviations in systems' performance and corrects malfunctions
- *C. Improves or Designs Systems*--suggests modifications to existing systems and develops new or alternative systems to improve performance

Technology:

Works with a variety of technologies

- *A. Selects Technology*--chooses procedures, tools or equipment including computers and related technologies
- *B. Applies Technology to Task*--Understands overall intent and proper procedures for setup and operation of equipment
- *C. Maintains and Troubleshoots Equipment*--Prevents, identifies, or solves problems with equipment, including computers and other technologies

APPENDIX C

WOLFTEVER WATCH

Wolftever Watch

Mission: Environment Inc.

September 14, 1996

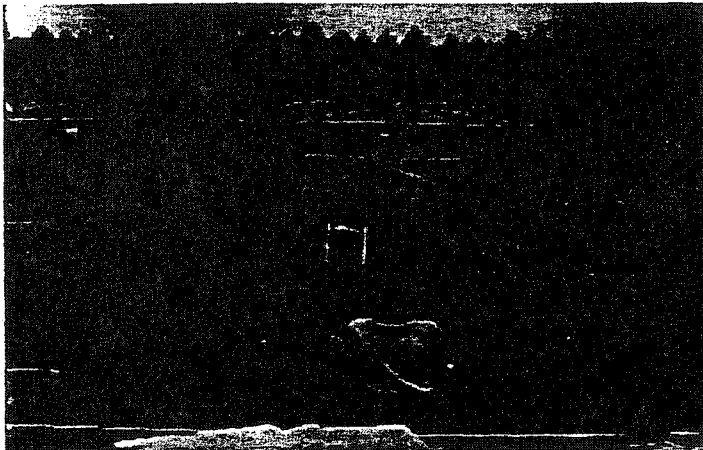
"Teens Caring For His World"

The Wolftever Creek Project What's Up?

The Wolftever Creek project was developed for the 7th and 8th grade students at A.W. Spalding to create excitement about learning and to provide students with an opportunity to produce something which would have a positive impact on their community.

It has helped the students to become involved in preserving the world's natural resources and to appreciate God's creation. The students have had a chance to work with various local agencies including TVA, the Chattanooga City Planner's Office, the Collegedale City Commission, and the Hamilton Soil Conservation District Office. Involvement with these and other organizations will continue through this school year.

-Brian Henning



Environmental Project Receives Award

On August 9 Gerald Linderman and Jean Lomino were given the "Outstanding Conservation Teacher's Award" for Hamilton County. The award was given at a Hamilton County Soil Conservation District recognition dinner.

First grade teacher, Mary Jane Ries who received the award in 1994, notified the Soil Conservation Office about the Wolftever Creek project. Mrs. Pam McNabb, administrative assistant of the Soil Conservation District, then nominated Linderman and Lomino for this honor. The purpose of the conservation award is to create the awareness and appreciation of the value of conservation education and to stimulate the efforts of teachers. "I'm proud of this award because the students are working hard to protect our environment, and they should be recognized for that," says Lomino.

-Florence Merryman

In the play, "Les Miserables" there's a scene in which the spy for the revolutionaries comes back from behind enemy lines to report the condition of the French army. He goes into detail, describing the vast number of enemy soldiers, their array of weapons, and most importantly, the French army's secret plans. "The French army is going to encircle us and starve us out!" he says. The spy then proceeds to encourage the revolutionary army to retreat.

Without warning, a small boy steps out of the shadows and deftly tells of the spy's treachery and his attempt to strike a deal with the enemy. After hearing this, the Captain of the revolutionaries hands the spy over to the army of angry freedom fighters so they can do as they please with him. The boy concludes, "That just goes to show what little people can do."

While I'm sure none of the 7th and 8th graders at A.W. Spalding consider themselves "little people", (including myself), in reality we are. Our corporation is one of the "little people" in the business world.

We are no longer merely students of A.W. Spalding School, we are employees of Mission Environment Inc. Our mission is to clean up our environment.

Mission Environment Inc.'s first task is to restore Wolftever Creek. Seventh and 8th grade students have invited city planner, an archaeologist, and TVA water quality control personnel to A.W. Spalding School to aid us in preserving Wolftever. We have even transformed one of our 8th grade classrooms into a museum about Wolftever Creek. Our slogan sums it up, "Teens caring for HIS world." As Christians it is our duty to preserve the world God has given us.

Mission Environment is divided into 14 groups, each with a special purpose. They quickly and efficiently handle all the business in our business. There are groups for writing newsletters, maintaining the corporation web page, raising funds, and many other purposes. This project has radically changed the way school is taught.

Mission Environment will be functioning years into the future, and any man or woman who concludes otherwise will have to answer to a band of determined students and teachers.

-Bernard Parham

Spalding Museum Opens

A museum has been set up in Mrs. Lomino's classroom. The museum's purpose is to get the community interested in preserving Wolftever Creek. The museum, created by 7th and 8th grade students, includes colorful picture books made for younger students and animals (both live and stuffed specimens) representing the wildlife found in and around Wolftever Creek.

Hands-on activities include looking at a drop of creek water under a microscope, finding the creatures that live in a rotten log, and making pictures from natural materials. There is also an exhibit showing the Indian presence along the creek and the early recorded history of the creek. In the museum one can see a mural which was painted by Dr. John Baker and a group of 8th grade students last year. The mural represents the wetland and riparian habitats of Wolftever Creek.

Admission is free, so why don't you just come on over and learn all about Wolftever Creek—its past, its present, and its future. You'll be surprised at what we have in store for you.

The museum will be open to the public on October 19, from 3:00-5:00 p.m.

-Nicole Bechard

Wolftever Watch Staff
Nicole Bechard
Brian Henning
Collin McFadden
Florence Merryman
Bernard Parham

Fish Sampling

A crew of TVA biologists came to Spalding late last semester and picked up a few special pre-selected students to go to a local creek. There the students assisted in some fish sampling. They used special shocking probes that stunned the fish. The fish floated into a large net placed just slightly downstream. As they floated downstream there were two people with small dip nets catching any fish that didn't get stunned. "After we caught the fish, we brought up the nets and first tossed out all crayfish and anything else that got in the nets," says Brian Henning. Then a biologist called out the fish types that were in the nets, and the fish were released back into the water.

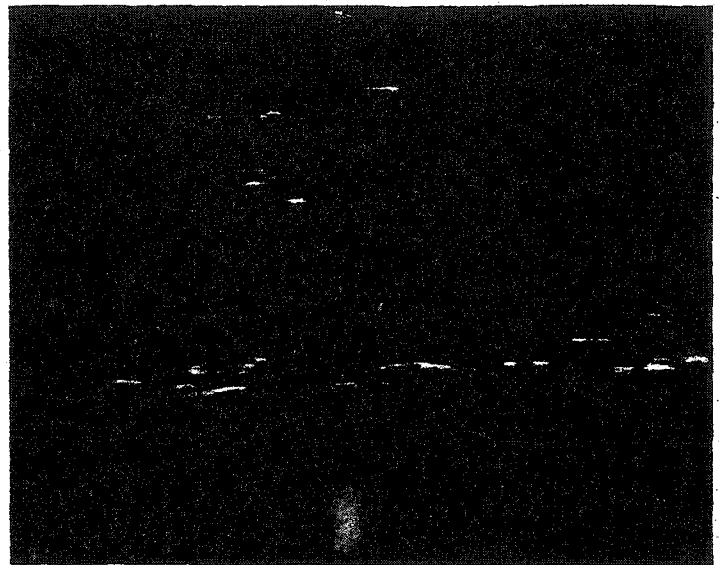
-Collin McFadden

Plans Underway for Lab

At the end of last school year, plans were already made to tear down the wall separating the English classroom from the science lab. The purpose of tearing down the wall is to create access for students from both classrooms to a multi-purpose computer/science lab.

Gerald Linderman 7-8 science teacher, has this to say, "We feel that this floor plan will provide more efficient work space so we can continue to teach interdisciplinary curriculum like the Wolftever Creek project"

-Florence Merryman



Picture showing trash along Wolftever Creek

Wolftever Creek Clean-Up

On Sunday, September 29, there will be a creek clean-up from 9:00 am until 1:00 pm. Free T-Shirt to early arrivals. It will begin at Imagination Station. You are encouraged to bring gloves and a sack lunch.

Equipment Needed for the Wolftever Creek Project:

- * Lapel Microphones
- * Computers
- * Video Projectors
- * Microscopes
- * Water/Air Quality monitoring equipment
- * Office Wall Dividers
- * Office Supplies
- * Donations will be appreciated

If you Wish to Make a donation call the school at:
396-2122

If you would like to be on our mailing list please write to the following address:

Wolftever Watch
P.O. Box 568
Collegedale, TN 37315
or call: 396-2122

or e-mail:

lindermn@southern.edu

or

bhenning@southern.edu

Wolftever Watch

Mission Environment Inc.

"Teens Caring For HIS World"

February 19, 1997

We Have A "Mission"

In the past, Wolftever Creek was beautiful! Imagine a heron gliding onto the creek, then walking around the rocks searching for food while a raccoon busily washes a crawdad in a small puddle. Fish of all sizes are darting between rocks and hiding in crevasses. Along the bank is an Indian village with small boys and girls splashing in the cool, refreshing water.

Today Wolftever Creek is almost as beautiful, but a new alien substance has "invaded" it. Trash and junk litter the creek, both in and around it. When I was a little girl, my family and I used to wade along Wolftever Creek, and under almost every rock, I would find a crawdad or fish. Now whenever I go, I can't wade because of little bits of glass hiding in the water, and it's hard to find crawdads anymore because of the pollution in the water.

Cleaning up Wolftever Creek is, to the 7th and 8th graders of A.W. Spalding, our "mission." The Wolftever Creek project was started in March of 1996 and has progressed quite rapidly between March 1996 and the present.

We invite you all to please help support our dream of making Wolftever Creek the beautiful waterway it once was.

-Esther Bonney

Greenway Update

A greenway is a paved path set aside for recreation and to preserve nature. The greenway will be built by the city of Collegedale and city of Chattanooga. It is going to be 1.8 miles long, and will run from the mini-park to Imagination Station Playground. The greenway will provide a nice place for the community to walk, bike, skate, and enjoy the creek area.

The greenway will be built as soon as funds are obtained from the state in the form of grants.

Where Are the Animals?

Some of the natural beauty has disappeared from Wolftever Creek and so has some of its wildlife. Most noticeable among the wildlife that is missing are the wood duck and the large mouth bass. The wood duck is a very beautiful bird. Actually it is said to be one of the most beautiful birds in North America. Their upper feathers shine with a brilliant green, blue, and purple. Underneath the wing is even more dynamic with contrasting colors of red, yellow and white. These beautiful birds are only about 20 in long.

These birds are a real treasure. In the early 1900's wood ducks almost became extinct because of over-hunting and loss of habitat. Because of new-found environmental interest in these lovely birds, they are making a strong come-back in the environment. Now we are working to bring them back to Wolftever Creek.

Another animal we have lost is the large mouth bass. This fish can weigh anywhere from 1-10 pounds. The largemouth bass in Wolftever Creek have been going to other places because of silt in the water, which is not good for them. We hope that with the cleaning of the creek, this fish may find its home there again. Fight with us to bring back these animals!

Students Plan Video Production

The Video Group of Mission Environment Inc. is working on a video that they will take to a wetlands conservation convention in early May in Alexandria Virginia. Some of the top environmental leaders will be there. Mission Environment is getting help from some of the students at Southern Adventist University. SAU's videoproduction class has been working with them. The students are excited about their chance to show people what a few "Teens Caring For HIS World" can accomplish.

Wolftever Book Planned

Right now the 7th and 8th graders are working on a book about Wolftever Creek and the animals that live there. It will include stories, pictures, reports, and poems. We would like to publish it around late April or early May. The money we get from the book will go towards the greenway project. We plan to sell it at area stores.

Nature

Nature is a precious thing
That we must protect

Nature is a wonderful thing
That we have to discover

Nature is a beautiful thing
That can be hurt

So protect our precious,
wonderful beautiful,
fragile, nature
And it will pay us back.

- Megan Renee' Wiley
(An Excerpt from the
Wolftever Book)

And Now A Word From Our President

As President of Mission Environment I try to lead the corporation with a productive and cooperative attitude toward the common goals of the corporation. This is not always an easy task, especially since this is a student-run corporation. Not that a student run system is bad, but like all students, we have other things to tend to than Mission Environment, like school itself. This is a common obstacle that all employees of Mission Environment, and myself often encounter.

My first goal as president is to build up a strong foundation for the corporation, so that it would be able to operate smoothly and efficiently without falling apart. The first thing we needed to do was to legally incorporate ourselves. After much trial and error, our charter was officially filed to the Tennessee secretary of state as of December 11, 1996.

- Kylie Allen

Museum Serves Many Purposes

The museum that was set up in Mrs. Jean Lomino's 8th grade classroom has been used to teach some of the other classes about different science topics. The 8th grade teachers assign a group of students to study up on a subject and they then teach that unit. One group of 8th graders already made a presentation on the bones of the body for Mrs. Kiser's 6th grade classroom. It was a big hit. The kids were able to experience learning the fun way. It is even educational for the students who do the presentation because they have to study the subject before they can teach it.

Mission Environ- ment Recieves Local and Re- gional Publicity

Crystal Candy is a student studying to be a journalist at Southern Adventist University. She seemed to be very interested in what we were doing at Mission Environment. She came with News Channel 3 cameras to film the Wolftever Museum, and Mrs. Ries's 1st grade class that was visiting that day. The newscast was aired in December.

Crystal Candy has offered to help us make a video. She came and instructed us on making video presentations. We look forward to working with Ms. Candy.

Mission Environment was also featured in the Febuary issue of Southern Tidings.

If you would like to be on our mailing list please write to the following address:

Wolftever Watch
P.O. Box 568
Collegedale, Tn 37315
or call: 396-2122
or e-mail:
lindermn@southern.edu

Wolftever Watch Staff

Amanda Roll
Katherine Brown
Florance Merryman
Esther Bonney
Brian Henning
Megan Wiley

Equipment Needed for the Wolftever Creek Project

* Adobe PageMaker 6.0 for IBM
* Computers
* Video Projectors
* Water/Air Quality monitoring equipment
* Office Wall Dividers
* Office Supplies
* Donations will be appreciated
If you wish to make a donation call the school.

Wolftever Watch

Mission Environment News Letter

March 1999

"Teens Caring For His World"

What is Mission Environment?

Mission Environment, Inc. is a unique student organization in Collegedale, Tennessee. The seventh and eighth grade teachers at A.W. Spalding Elementary School want their students to have a comprehensive education and make their learning relevant to real world concerns. They accomplished their vision by integrating the student-owned and -operated Mission Environment, Inc., into the curriculum, classroom, and community. Organized into divisions of a corporation, students have worked in self-managing teams on public relations, art and design, publishing, history and archaeology, field work and The Globe Project, computer and weather, gardening and landscaping and video production. From ground truthing for the LandSat Satellite to a public environment awareness campaign to save the Wolftever Creek, the students gain basic competencies through a variety of experiences.

--1997 Resource Guide For the Tennessee Commission on National And Community Service.

Lessons Learned

Lessons can be learned from every thing we see. Here is a lesson that a student from Spalding has developed about a fallen tree.

The tree has a very complex root system that helps it stand. If the roots are deep in the soil, the tree will stand any storm it may face. But if the roots are shallow the tree will be blown over and all life will be lost.

The same is true in our lives. If our roots are deep in Jesus Christ, the strongest foundation, we are firm and will stand strong through all of life's trials. But if our root system is shallow, not in God, we may look strong, but we are "goin' down."

—Ryan Litchfield

Carefully wades in the water

Ready for dinner to buzz by

Every minute hes watching

Eating a delicious fly

Keeping to himself

Finally full, he hops away

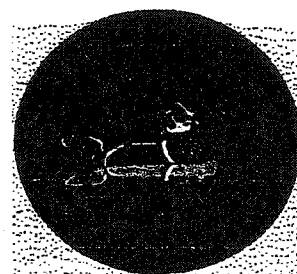
Rock to rock

On skilful feet

Graceful jumps not missing a beat

—Mark Cloutier

The Logo You See!

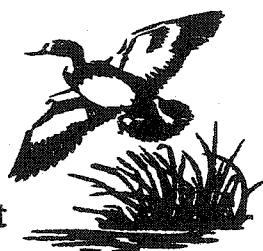


During the 1997-1998 school year a contest was held for students of the Greater Collegedale School system to design a logo for the Wolftever Creek Greenway. Mandy Wolf, a sophomore at Collegedale Academy, was the winner of the contest. She and two runners up received money for their contribution to the Greenway. The logo will be on signs for the Greenway and T-shirts handed out at the Wolftever Creek Greenway Celebration.

—Kelly McFarland

The Wood Duck

Wolftever's Mascot



As you walk through and enjoy our new Greenway, chances are you won't see a wood duck along the way. This colorful duck has been adopted as the mascot for Wolftever Creek.

The wood duck was once very common along Wolftever Creek. But it has become increasingly rare over the years. And, just a few years ago, had almost vanished. But, thanks to conservation efforts like this one, we can still enjoy one of the most beautiful birds in the world—right here in Collegedale.

One of the biggest problems for the wood duck is suitable habitat. The wood duck is one of the only ducks that nests in tree holes, typically old growth near the water. After finding a tree like this or one of the many nest boxes put up by conservation groups, the female lines the nest with her own down feathers and incubates the eggs for about 30 days. After hatching, the ducklings leap to the water. Amazingly, even though they are not able to fly for another 8 weeks, they can jump from heights of 50 feet or more without being hurt in the slightest.

The mother duck then starts teaching them to forage for seeds, grasshoppers, tadpoles, or even small fish and crayfish. These little ducklings will soon grow up to about 20 inches in length.

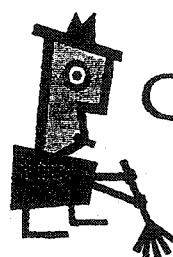
If we continue to take care of our creek, we can enjoy unique and interesting animals like the wood duck for years to come.

—Luke Padgett

Students Create Wolftever Museum!

In an effort to help educate the community students at A.W. Spalding School created a museum at their school. Live and stuffed animals, as well as pictures of wildlife in and around Wolftever Creek are displayed. Hands on activities to find out what lives in a decaying log and what organisms can be found in water are popular learning stations for visitors. An Indian village replica shows early-recorded history of the creek. On display today is a portion of this museum.

—Kelly McFarland



Creek Clean-Up!!!

On, Tuesday, March 23, the eighth graders from A.W. Spalding School walked from their school down to the Wolftever Creek Greenway. The student's walk was not just for fun, but to clean up the creek and Greenway. The students worked for an hour and a half to prepare the Greenway for the Grand Opening Celebration. The students picked up trash and scrap metal from the small creek. Some students cleaned the area around the Library and Imagination Station while other clean the Greenway area. The whole city of Collegedale has worked to make our Greenway possible.

Several other creek cleanups have been held in the past. The most well known is the Tennessee River Rescue. Wolftever Creek has only been a part of the River Rescue for three years. The River rescue is held sometime in October. If you are interested in helping clean up the creek contact Jean Lomino at 396-2122 or watch for the signs for the Tennessee River Rescue.

—Kelly McFarland

THE WOLFTEVER WATCH

The Official Newspaper of Mission Environment Inc.
Volume II "To encourage everyone to preserve and protect our natural environment" Issue I

A Note from the Editor By Melissa McConaty

This is the first issue of Volume two of the Wolftever Watch. This is my first time working on this paper and I'm looking forward to it. We have a great staff this year, which includes both Collegedale Academy students and A.W. Spalding students. Our goal this year is to put out the best newspaper that we can for you. I hope you enjoy this issue of The Wolftever Watch.

How Gross! Editorial By Christie Rennard

Trash bags float eerily, sandwich wrappers litter the banks, drifting plastic bottles bob in the water. All of these and more clutter Wolftever Creek.

Many people aren't trying to hurt out environment by littering, they simply don't know about this important waterway and how it helps us out. Not only is it important to be aware of the problem, it is also important that you, the public, understand how important this creek is. In the future let's not litter our environment, because I'm tired of hearing "How gross!" When referring to Wolftever Creek.



Help the Animals Editorial By Olivia Hale

Call 911! Call the Police! Call the Pound! Wait a minute, what can they do? Well, we have to do something. I believe that animals are the most important part of Wolftever Creek. What is a creek without all of the creatures that live there?

This is something that worries me. I think we should start thinking about how we can help the animals. Maybe we could try to replenish some of the animals that are disappearing from there like the wood ducks. What do you say? Let's try and think about some ways that we could help out the animals this year.

Students Aid Wolftever By Emily McArthur and Brian Henning

It was a wet, foggy, Sunday morning. Students were gathered at Ooltewah Middle School. They were teens on a mission: To clean up Wolftever Creek. What? Teenagers cleaning up a creek at 8am? But they were getting a lot of science credit for this and they were helping the environment.

Everyone was divided up into groups and was assigned various portions of the creek to clean up. There was a lot of unusual stuff removed from the creek. Such as a door, broken washing machine, and old toys. Autumn Saxon, one of the students from AWS said, "It's pretty fun and it's good to help." Wolftever still isn't completely clean but everyone who came out that day had a part in preserving Wolftever Creek.

Building the Dream A tribute to the Sophomores

We would like to thank the AWS Eighth grade class of 96' who got this project going only to graduate soon after they got started. For a year they watched as the class of 97' took over where they had left off. Now, they have a chance to be involved in the project that they started. Thanks for all of your help and hard work sophomores!



Cans for Christ By Destiny Edwards

CA's trash contained paper, left over lunches, soda cans and whatever else was tossed in. This was noticed and Cans for Christ, a recycling mission was started. Sure, people still throw cans into CA's trash because they have decided not to participate in.

The soda cans that have been placed in the bins have already been exchanged for money that will be going to a little village in Peru. Please encourage your family, friends, and neighbors to participate in this worthwhile project.

Thank you to all that have faithfully recycled cans. You are helping put a smile on a face that you don't know.

Spiderman!

By Luke Padgett

Believe it or not there is a real Spiderman. He is lurking around the banks of Wolftever Creek. He is about 1/4 of an inch long, and he comes out at night. You can see his glowing eyes with the aid of a flashlight.

Everyone knows that there isn't really a Spiderman, but this is pretty close. He is known as the Jumping Spider. He gets his name from his unusual hunting techniques. First he stalks his prey, and then he anchors himself onto whatever he is standing on with a fine piece of web. With his excellent vision he can leap in almost any direction without missing his mark. If he does, his web anchor keeps him from falling. After he catches the fly, moth, ant, or beetle he is going for, he injects it with poison from his little fangs. Then he eats it and moves on.

You can find this spider almost anywhere. Look for him to be out at night. Just be sure not to step on him!

Environment Facts

The average American family produces about 100lbs. of trash every month.

3 Million cars are abandoned in the U.S. every year.

An estimated 14 billion lbs. of trash are dumped into the sea every year.

Daybreak

On a still and quiet morn,
upon the grass the dew sleeps
A silent wind whispers,
birds sing a beautiful melody.
The creek skips along,
sunbeams creep to the sky.

Author Unknown

Environmental Tip: Use a Clean Detergent

Background

Phosphates are chemical compounds that contain Phosphorus are found in most detergents. Manufacturers use them because they soften water and prevent dirt particles from being re-deposited on clothes.

Unfortunately, there are severe ecological side effects: As phosphates empty into streams and lakes, they fertilize algae, causing it to grow out of control. When algae dies, the bacteria that cause it to decay-- a process requiring huge amounts of oxygen-- use up the oxygen that other plants and marine life need to survive. The result: lakes and streams can die.

Detergent Data

*Your detergent box should list the amount of phosphorus "in the form of phosphates." But that's not the phosphate content; to get the actual amount, multiply the percentage of phosphorus by 3, for example: 8% phosphorus = 24% phosphates.

*Phosphates aren't necessary. In areas where phosphate use is regulated, powdered detergents have less than 0.5% phosphates.

Simple Things You Can Do

*Use Less Detergent.

According to a consumer Consumer Report many manufacturers recommend more than necessary.

*Use a low-phosphate or phosphate-free detergent. Liquid detergents are generally phosphate free.



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APPENDIX D
MEAK SURVEY INSTRUMENT

Environmental Survey

This survey is part of a research project being conducted by a doctoral student at Andrews University. The administration of Collegedale Academy has given the researcher permission to survey the senior class. Although you are under no obligation to complete this survey, your assistance in doing so will be greatly appreciated. The more students who complete the survey, the more accurate the results.

Anonymity:

By completing this survey, you are consenting to participate in this research project. The data gathered in this survey will be kept in complete confidence. No student will be identified in the survey results. To ensure anonymity, all survey response forms will be destroyed after the information has been entered into the computer data base.

Instructions:

1. Please read all questions carefully.
2. Please don't spend too long on any one question.
3. If you do have any trouble answering a question, circle the question number and answer the question the best you can.
4. Please answer all questions honestly.

Thank you!

ECOLOGICAL ATTITUDES AND KNOWLEDGE

Personal Information: Age _____ M F

I participated in Mission Environment at A. W. Spalding. Yes No

Directions: Please *CIRCLE* the appropriate number for your response.

Section I	Strongly Agree 1	Mildly Agree 2	No Opinion 3	Mildly Disagree 4	Strongly Disagree 5
1. I'd be willing to ride a bicycle or take the bus to work in order to reduce air pollution.	1	2	3	4	5
2. I would probably never join a group or club which is concerned solely with ecological issues.	1	2	3	4	5
3. I would be willing to use a rapid transit system to help reduce air pollution.	1	2	3	4	5
4. I'm not willing to give up driving on a weekend due to smog alert.	1	2	3	4	5
5. I'm really not willing to go out of my way to do much about ecology since that's the government's job.	1	2	3	4	5
6. I would donate a day's pay to a foundation to help improve the environment.	1	2	3	4	5
7. I would be willing to stop buying products from companies guilty of polluting the environment even though it might be inconvenient.	1	2	3	4	5
8. I'd be willing to write my congressman weekly concerning ecological problems.	1	2	3	4	5

9. I probably wouldn't go house to house to distribute literature on the environment.	1	2	3	4	5
10. I would not be willing to pay a pollution tax even if it would considerably decrease the smog problem.	1	2	3	4	5

Section II			Directions: Please answer these questions concerning your conservation practices since you began high school.		
1. I guess I've never actually bought a product because it had a lower polluting effect.			True		False
2. I keep track of my congressman and senator's voting records on environmental issues.			True		False
3. I have never written a congressman concerning the pollution problems.			True		False
4. I have contacted a community agency to find out what I can do about pollution.			True		False
5. I don't make a special effort to buy products in recyclable containers.			True		False
6. I have attended a meeting of an organization specifically concerned with bettering the environment.			True		False
7. I have switched products for ecological reasons.			True		False
8. I have never joined a cleanup drive.			True		False
9. I have never attended a meeting related to ecology.			True		False
10. I subscribe to ecological publications.			True		False

Section III	Strongly Agree 1	Mildly Agree 2	No Opinion 3	Mildly Disagree 4	Strongly Disagree 5
1. I feel people worry too much about pesticides on food products.	1	2	3	4	5
2. It frightens me to think that much of the food I eat is contaminated with pesticides.	1	2	3	4	5
3. It genuinely infuriates me to think that the government doesn't do more to help control pollution of the environment.	1	2	3	4	5
4. I feel fairly indifferent to the statement: "The world will be dead in 40 years if we don't remake the environment."	1	2	3	4	5
5. I become incensed when I think about the harm being done to plant and animal life by pollution.	1	2	3	4	5
6. I'm usually not bothered by so-called "noise pollution."	1	2	3	4	5
7. I get depressed on smoggy days.	1	2	3	4	5
8. When I think of the ways industries are polluting, I get frustrated and angry.	1	2	3	4	5
9. The whole pollution issue has never upset me too much since I feel it's somewhat overrated.	1	2	3	4	5
10. I rarely even worry about the effects of smog on myself and family.	1	2	3	4	5

Section IV

Directions: Circle the letter which you believe best answers the question.

1. Soil pollution is generally due to: A) sparse rain, B) improper farming methods, C) poisonous metals, D) over-fertilization, E) poor crop rotation.

A B C D E

2. Most smog in our big cities comes from: A) automobiles, B) supersonic jets, C) industrial plants, D) large trucks, E) refuse disposal.

A B C D E

3. High concentrates of chlorinated hydrocarbon residues: A) cause sheep to die B) are found in large amounts in our atmosphere, C) accumulate in flesh-eating birds and upset breeding behavior, D) are no longer legal in pesticides, E) are readily biodegradable.

A B C D E

4. Mercury has been found at unacceptable levels in A) fruit, B) vegetables, C) seafood, D) beef, E) soft drinks.

A B C D E

5. Which of the following does not appreciably reduce the pollution by automobiles? A) properly tuned engine, B) high octane gas, C) low lead gas, D) smog control devices, E) propane engines.

A B C D E

6. The most common pollutants of water are: A) arsenic, silver nitrates, B) hydrocarbons, C) carbon monoxide, D) sulphur, calcium, E) nitrates, phosphates.

A B C D E

7. Ecology is best described as the study of A) the relationship between man and the environment, B) the relationship between organisms and the environment, C) pollution and its control, D) the environment, E) recycling of products.

A B C D E

8. Which of the following materials usually takes longest to decompose? A) tin, B) iron, C) copper, D) aluminum, E) steel

A B C D E

9. Birds and fish are being poisoned by:

- A) iron, B) mercury, C) silver, D) lead,
E) magnesium

A B C D E

10. All but one of the following decompose in ocean water: A) sewage, B) garbage, C) tin cans, D) plastic bags, E) chemical fertilizer

A B C D E

11. What is the harmful effect of phosphates on marine life? A) causes cancer, B) renders fish sterile, C) induces nervous reactions in fish, D) makes H₂O cloudy, E) feeds algae which suffocates fish

A B C D E

12. Which of the following well-known groups is primarily interested in conservation issues?

- A) Boy Scouts of America, B) The Sierra Club, C) Kiwanis, D) 40-H Club, E) The Ecology Association.

A B C D E

13. Practically all of the lead in our atmosphere is caused by: A) cars, B) industrial plants, C) airplanes, D) burning refuse, E) cigarettes.

A B C D E

14. DDT takes how long to deteriorate into harmless chemicals? A) it never does, B) 10-20 months depending on the weather, C) about 200 years, D) about 400 years, E) anywhere from several days to several years.

A B C D E

15. Ecology assumes that man is: a(an) _____ part of nature. A) differential, B) integral, C) inconsequential, D) superior, E) original

A B C D E

REFERENCE LIST

REFERENCE LIST

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